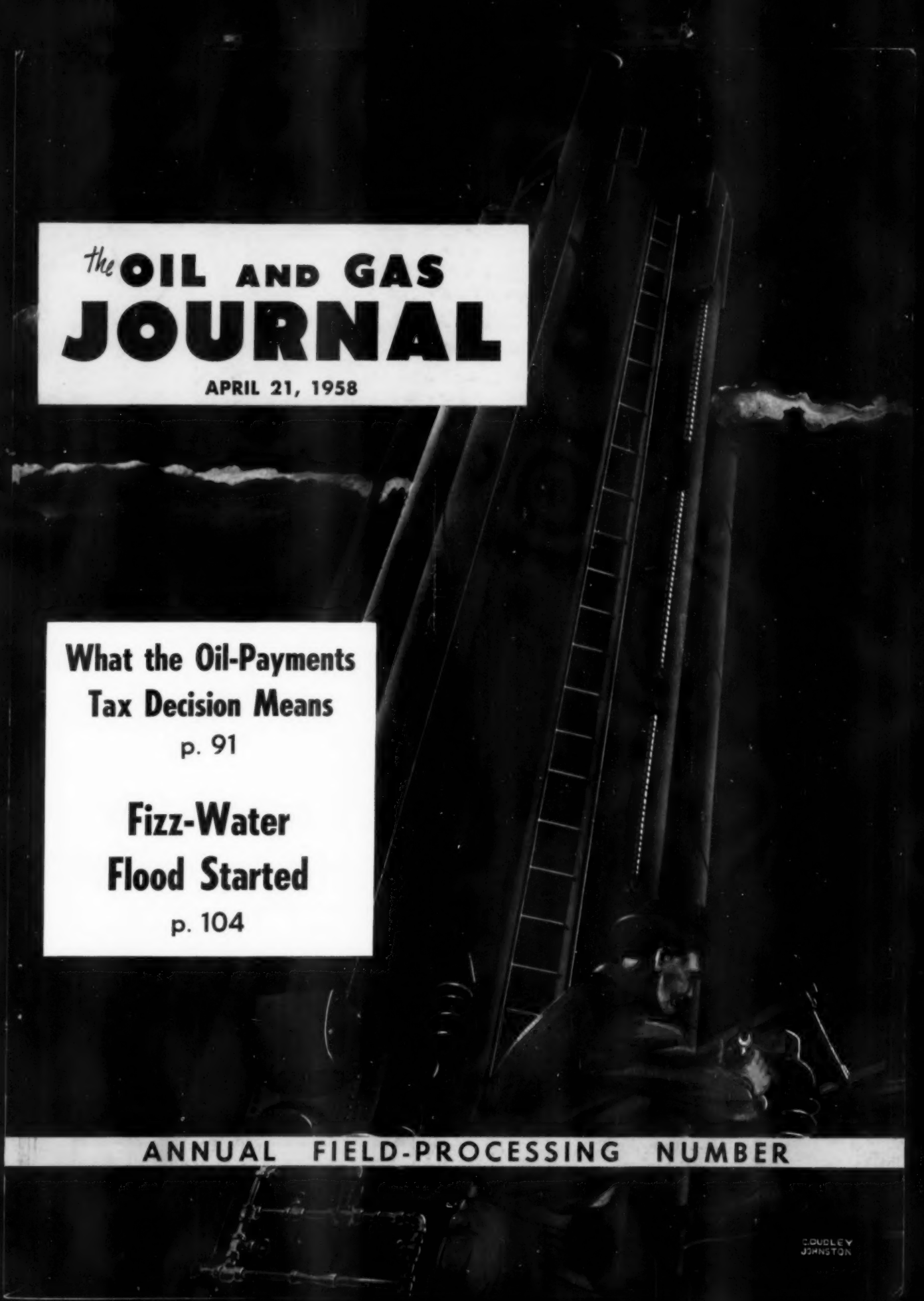


the OIL AND GAS JOURNAL

APRIL 21, 1958

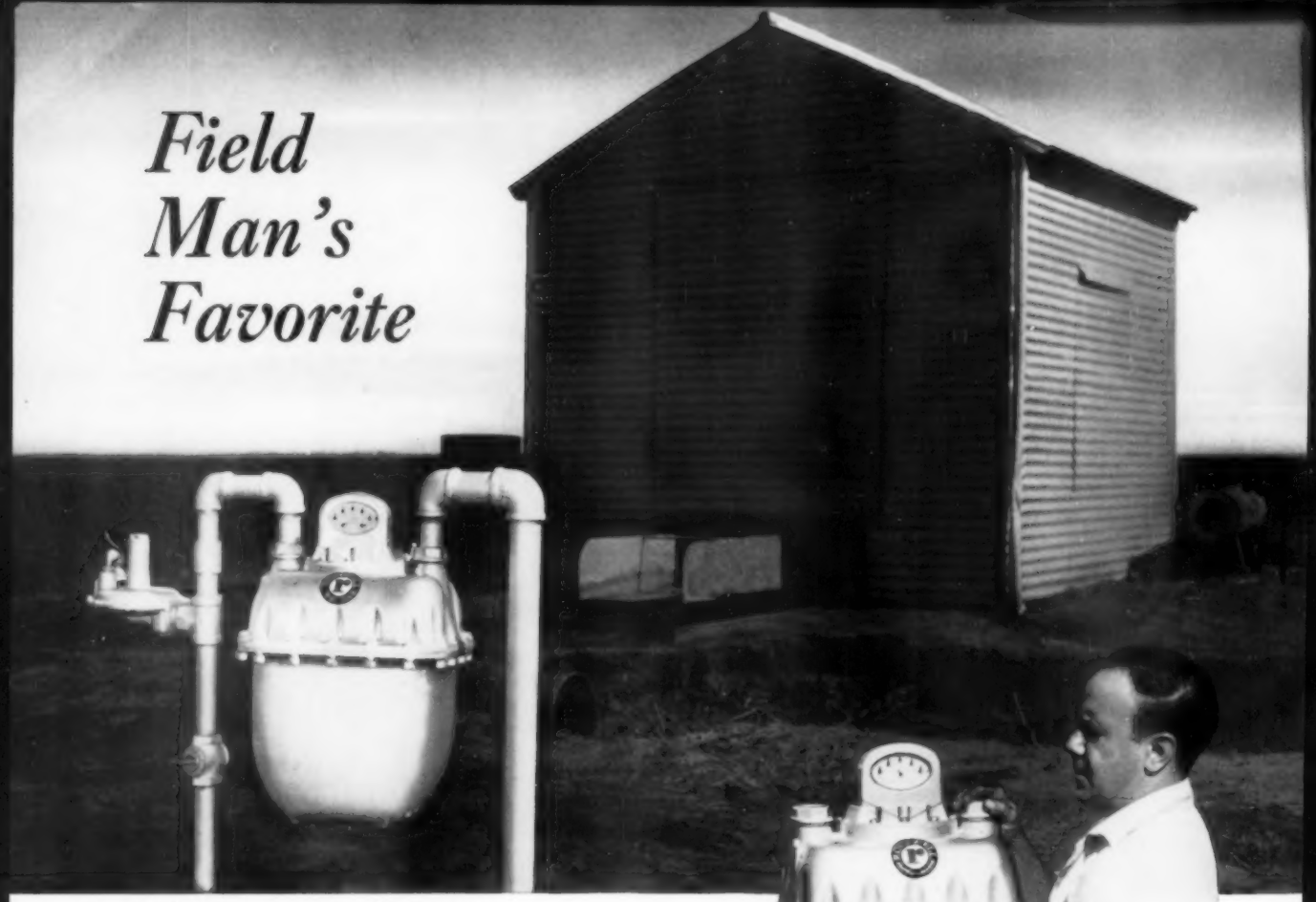
What the Oil-Payments Tax Decision Means
p. 91

Fizz-Water Flood Started
p. 104

ANNUAL FIELD-PROCESSING NUMBER

DOUDLEY JOHNSTON

Field Man's Favorite



Rockwell "1600" aluminum gas meter and Rockwell "173" service regulator measuring gas engine consumption in Texas.

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Easiest to handle, install, service!

The Rockwell "1600" has *big* capacity —1600 cfh at 4 oz. inlet pressure. Yet this meter stands only 24 inches high. It weighs a mere 63 lbs, so one man can carry and install it with ease. The sturdy aluminum alloy case is designed to withstand bumps and knocks common to field service. And, with a corrosion-resistant aluminum case, weathering is no problem. The Rockwell "1600" is rated for 100 psi inlet. When measuring gas at pressures above base, either an Emcorector or a Combined Record gauge can be fitted. Write for details to Rockwell Manufacturing Company, Pittsburgh 8, Pa.

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- Field Processing
- Irrigation Fuel Service

ALUMINUM GAS METERS

another fine product by

ROCKWELL

the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
April 21, 1958

The Supreme Court may have saved oil a future headache:

Oil lawyers tend to take this view of court decision declaring income from some carved-out oil-payment plans is ordinary income and not a capital gain.

They regard these sales of future production as a tax loophole which might have led to retaliatory laws endangering the depletion allowance.

Oil operators, however, still can make outright sales of properties with payment made out of future production. Legal test is whether seller relinquishes his rights permanently or is to get them back again (p. 91).

The price picture:

...California heavy crudes dropped from 2 to 20 cents per barrel. Fuel oil also was cut 20 cents a barrel.

...Pennsylvania-Grade crude fell 25 cents a barrel. It's the third cut for this crude in less than a year.

...Condensate continued downward trend with new cuts in Texas, Oklahoma, and New Mexico by Phillips, Standard of Texas, and D-X Sunray.

Should production from water floods be prorated?

Current cutbacks have made the question a hot one. The latest survey shows:

...In Texas, water-flood production exceeds state's allowable by only 1 per cent.

...In Oklahoma, the excess is less than 2 per cent.

The conclusion: Proration of floods is not needed. But the states should fix a policy that will differentiate between true water floods, pressure-maintenance projects, and salt-water disposal projects (p. 99).

Oil researchers have brought the atomic plane nearer.

Shell scientists say that a jet fuel which is resistant to high doses of gamma radiation can be made. Such a fuel is needed to power auxiliary engines of the first American A-plane.

A fuel which won't break down under radiation means a saving in weight because less shielding is needed. The discovery greatly aids problems faced by plane designers.

Gas continues the big news in western Canada.

Fort Nelson area of far northern British Columbia may rival the prolific Fort St. John gas field on the basis of four big Mississippian and Devonian gas discoveries.

Latest strike in this area is Gulf States-El Paso's 1-A Clarke Lake, 12 miles southeast of Fort Nelson. The well flowed more than 8,000 M.c.f. of gas per day from the Slave Point-Devonian.

Other producers in this promising area are Gulf States 1 Prophet River, Shell's Klua Creek, and Pacific Petroleum's 1 Fort Nelson.

Grande Prairie region in western Alberta also may hold major multipay gas reserves.

Triad Oil Co. has brought in three new gas reservoirs on a huge 700,000-acre farmout from Pan American. Triad hit gas at Big Mountain Creek, Haglund, and Grovedale—right in the middle of a vast, previously explored area (p. 229).

There's also some good oil exploration news from Canada.

Hudson's Bay has completed a 1-mile southwest extension to the Virginia Hills discovery in northwestern Alberta.

Its 4-20 Virginia Hills flowed 480 bbl. of oil per day from the Devonian.

A long southeast extension has been made to the Paradox basin's White Mesa field.

Continental Oil's 1 Navajo-C in San Juan County, Utah, flowed 50 bbl. of oil per hour on two tests in the Pennsylvanian at 5,871-5,922 and 5,922-6,011 ft. Location has been made for another well in the field at 2 Navajo-C.

Wildcatting is still active in Wyoming, especially in the Powder River and Green River basins.

Davis Oil Co. has staked new Mesaverde wildcat in Johnson County near its recent strike northwest of Dead Horse Creek field in the Powder River basin. Another test is being planned east of El Paso Natural's big Desert Springs discovery in the Green River basin.

Creole Petroleum has a string of significant secondary-recovery and fluid-injection projects started in Venezuela.

Two pilot experiments have started in Urdaneta field in western Lake Maracaibo. One will use raw naphtha to sweep out a 7½-acre oil zone. Other will use water.

Another water flood has started at Tia Juana, an older lake sector, and five others are in advanced planning.

Creole also has two gas-repressuring plants operating at Tia Juana with a third half built, has built repressuring plants in eastern Venezuela at Santa Ana, El Toco, Chimire, and has started an LPG extraction plant at Ule in the lake.

First full-scale carbon dioxide flood in the nation is under way in Oklahoma. Its success could mean a new process for tertiary as well as secondary recovery of oil.

Oil Recovery Corp. launched its project by injecting 600,000 cu. ft. of carbon dioxide daily into the Bartlesville sand underlying a 240-acre stripper lease near the center of Bartlesville-Dewey field.

Engineers think carbon dioxide can coax twice as much oil from the ground as the average flood and can be used with success where a field already has been flooded (p. 104).

Expect oil companies in Venezuela to start doing more of their own construction work, giving less to contractors.

The reason is the government's freeze on payrolls.

Venezuelan authorities won't permit any payroll reduction to correspond with lower level of operation. So companies will assign maintenance crews to projects which they normally would have contracted.

A 40 per cent cut in expansion plans for this year is being proposed by Tennessee Gas Transmission Co.

T.G.T. President Gardiner Symonds attributes the retrenchment to the controversial Memphis decision and also to the general business recession.

Expansion authorized by the FPC this year would cost an estimated $128 million. Indications now are the company will cut this back to $75 million. Major job in the approved plans is 550-mile, 30-in. line from Mississippi River delta below New Orleans to main line near Portland, Tenn.

New big-inch gas line from Texas to California is being proposed for FPC approval by Transwestern Pipeline (p. 100).

Company organized by Warren Petroleum, Monterey Oil, and J. R. Butler will lock horns with El Paso Natural both for gas in the field and for markets in California.

The plan: A 1,305-mile modern system. Two 24-in. supply laterals from Southwest Texas and from the Texas Panhandle converging at Roswell, N. M. Remaining 670 miles to Topock, Ariz., will be 30-in. line. Completion goal is mid-1959 for the $193-million project.

New method for oxidizing petroleum fractions to petrochemicals has come to light. It's noncatalytic.

Penn State, helped by Esso Research and Rohm & Haas, has developed an open-tube reactor. It operates on a high hydrocarbon-oxygen ratio in a rain of inert, finely divided solids.

The solids give uniform temperature control, prevent oxidation to carbon dioxide, and remove heat of reaction from the reactor. Fused alumina, sand, glass beads, mullite, zircon silicate, and cracking catalyst were used in sizes ranging from 125 to 300 microns.

A wide variety of olefins, epoxides, and aldehydes have been produced in the laboratory.

The chromatograph is becoming a process work horse. One of its big attractions is shown at Snyder gasoline plant. A stream analyzer there resulted in propane recovery which in a month was worth profit of $10,500.

The profitable recovery was more than twice the cost of the equipment (p. 117).

New gas-processing plant designed to handle 300,000 M.c.f. of pipeline gas will be dedicated this week near Eunice, La.

Plant is jointly owned by Runnels Gas Products Corp. and Texas Gas Exploration Corp.

It is latest in growing list of plants expressly built to extract liquids from the pipeline stream. The Eunice plant taps Texas Gas Transmission's line, and is scheduled to wring out about 5,000 bbl. daily of products from the gas.

Another refiner is making use of carbon monoxide boiler. Humble is including one with its new 50,000-bbl. fluid cat cracker due on stream at Baytown this spring.

The main attraction is fuel savings. It works like this: Large amounts of CO in the regenerator flue stream is channeled to the boiler. It is burned to CO_2 with the heat from combustion used to make steam.

Will nitroparaffins someday replace hydrocarbons in piston engines?

It's much too early to say. But this class of chemicals shows promise as a powerful fuel.

Research at University of California at Berkeley indicates that an engine's output may be doubled if nitromethane were substituted for isooctane.

Most likely use for nitroparaffins may be in diesels. Selfcontained oxygen and a tendency to preignite would be dual advantages in a diesel fuel.

Here's a new slant on hydrogenation of crude residuals. Esso Research has tested a thermal process using a so-called hydrogen-donor diluent. This may be any one of many condensed-ring aromatic-naphthene compounds.

The donor is partially hydrogenated. Then it is charged with residuum to a heating coil and an atmospheric tower. It gives up hydrogen to the residual fraction, producing high distillate yields with minimum coke and gas formation.

The donor is fractionated out and recycled to the hydrogenation unit for another load of hydrogen and another go-round with the residuum.

Good Wells Make Good News

A Monthly Report Of Successful Well Treatments

April 21, 1958

For versatility to meet a wide variety of well conditions, the nine basic Dowell fracturing services deserve serious consideration. Here are some reports on recent treatments showing what has been achieved when the correct service was used.

- **San Juan County, New Mexico.** (Old gas well) This well was completed in the Point Lookout sandstone from 5468 to 5532 feet. Production had decreased to three mmcfd. Before treating with Riverfrac® operator set five-inch liner and perforated six shots per foot. Dowell used nine rubber tanks to hold the water and six Allison pumpers to inject 135,000 gallons fresh water and 50,000 pounds sand *at 110 bpm. On four-hour test after treatment, well produced at the rate of over 36 mmcfd.*

- **Webster Parish, North Louisiana.** (New oil well) This well was completed in the Justiss sandstone through perforations from 9296 to 9321 feet. It swabbed ½ boph before treatment. Working with Dowell, the producer selected a multi-stage treatment designed to prevent troubles from silicate swelling. Treatment was basically Stratafrac®, using acid-kerosene emulsion as fracturing fluid; plus Mud Acid, regular acid with surface tension and silicate control agents, and perforation ball sealers. *After treatment, well potentialed 190 bopd.*

- **Southeastern Saskatchewan, Canada.** (New oil well) This well was completed in the Midale Beds limestone through perforations from 4409 to 4419 feet. After first acidizing, well swabbed 100 per cent water. Following remedial work, a second acid treatment resulted in only 10 to 12 barrels fluid (85 to 90 per cent water) per day. Operator then called in Dowell and ordered Acid Petrofrac®, injecting 5000 gallons acid-oil emulsion and 3000 pounds of sand down casing at 5 bpm. Because of corrosive waters, treatment was spearheaded with Corban® corrosion inhibitor in crude and followed with Corban and Freflo® in crude. *On last test, well was pumping 28 to 30 bopd with only 15 to 20 per cent water.*

- **Wayne County, Ohio.** (New oil well) Completed open hole in the Clinton sand, this well tested only a show of oil and gas. Operator selected Petrojel®, using 8000 gallons jelled crude and 16,000 pounds sand. Injection rate was 28 bpm at 1950 psi. After treatment, load was quickly recovered and *two weeks later the well was flowing 100 bopd with one mmcfd.*

Your Dowell engineer is prepared to give you complete information on any of Dowell's many fracturing services. Call any of the 165 Dowell offices in the United States and Canada; in Venezuela, contact United Oilwell Service. Or write Dowell Incorporated, Tulsa, Oklahoma.

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the OIL AND GAS JOURNAL

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Chromatograph Has Quick Payout at Snyder Plant 117
By Bruce Denny
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Chromatography Is Plant Workhorse 119
By J. F. Hickerson
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Annual Survey of Field-Processing Plants 130
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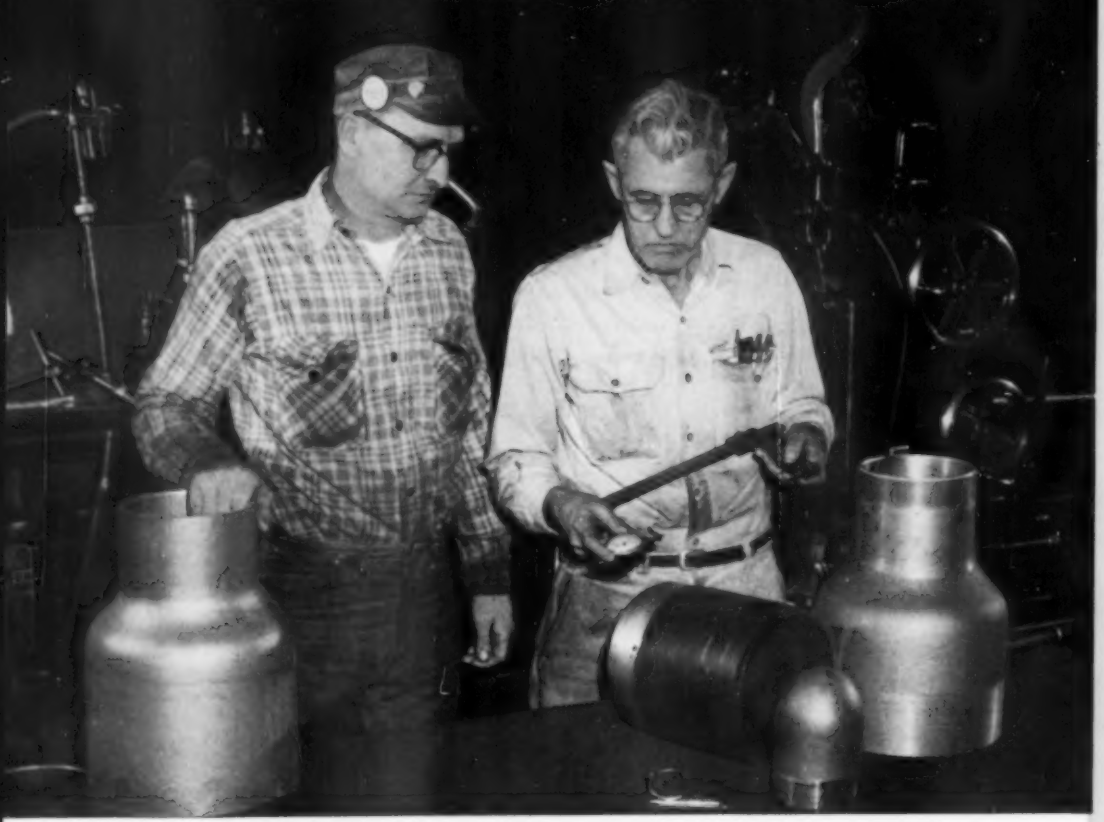
CARE AND EXPERIENCE

Make Better Plugs and Swages



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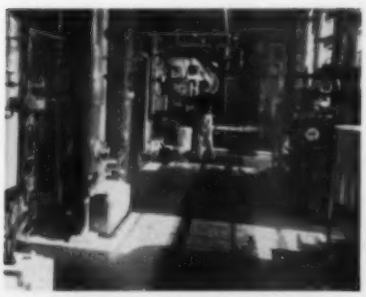
Recently, it was discovered that six inches of sludge had accumulated in the bottom of the tank. Constant temperature had to be maintained in the laboratories, so a tank-cleaning firm was called in. They gave a firm estimate of $800 for cleaning the tank mechanically. Considerable downtime would be required.



This is the powerhouse that *had* to maintain service, so that essential temperature control, in the laboratories it served, could also be maintained.

Looking for an alternative, the power superintendent decided to try using Du Pont Fuel Oil Additive No. 2 to break down the sludge. After one week of operation, during which only $20 worth of FOA-2 was used, no sludge could be detected. Moreover, there was no downtime. *The tank was in use all during the clean-up period.* Boiler room operations were completely trouble-free throughout the time the sludge was being dispersed and burned with the oil.

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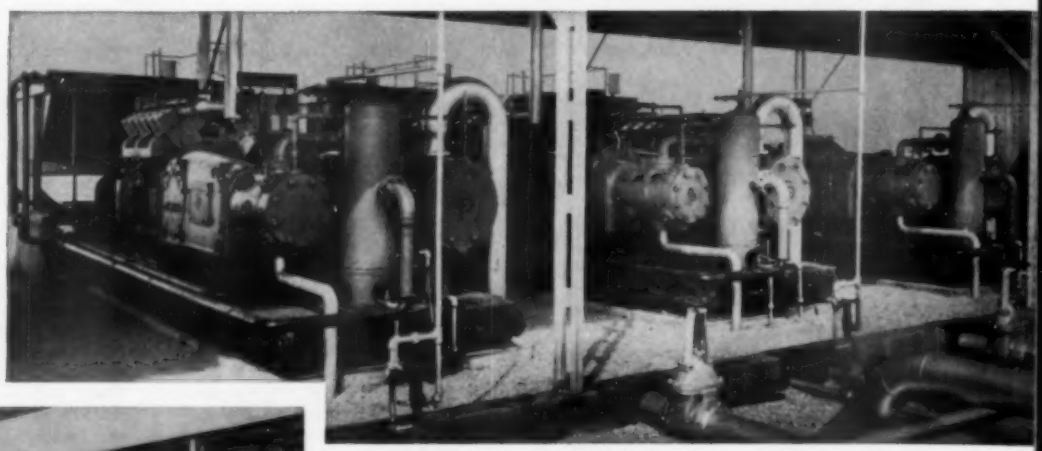
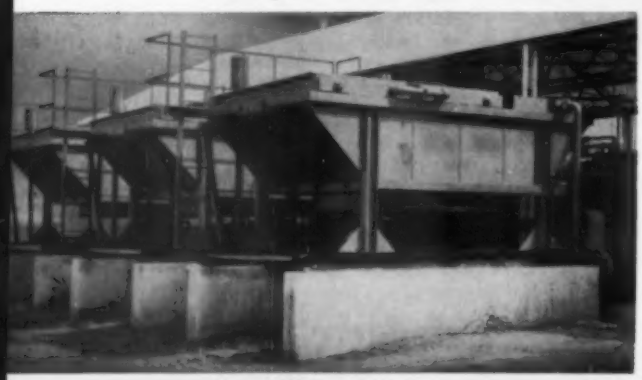
Units of this type are available in 125, 175, 200, 250 and 300-hp sizes. On all but the two larger sizes, up-draft radiators are mounted above the compressor gear box and supported directly from the skid base.

This bank of three direct-connected units are tied into a common header system, permitting flexibility of operation.



Heavy-duty, horizontal, up-draft radiators have divided cores for separately cooling engine and compressor. Circulating pumps and cooling fans are driven from the engine crankshaft by means of a torque tube and fluid coupling.



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Surfactants (Poly-Tergents)
Ethylene Dichloride
Dichloroethylether

Poly-G, Poly-Solv and Poly-Tergent are registered trademarks

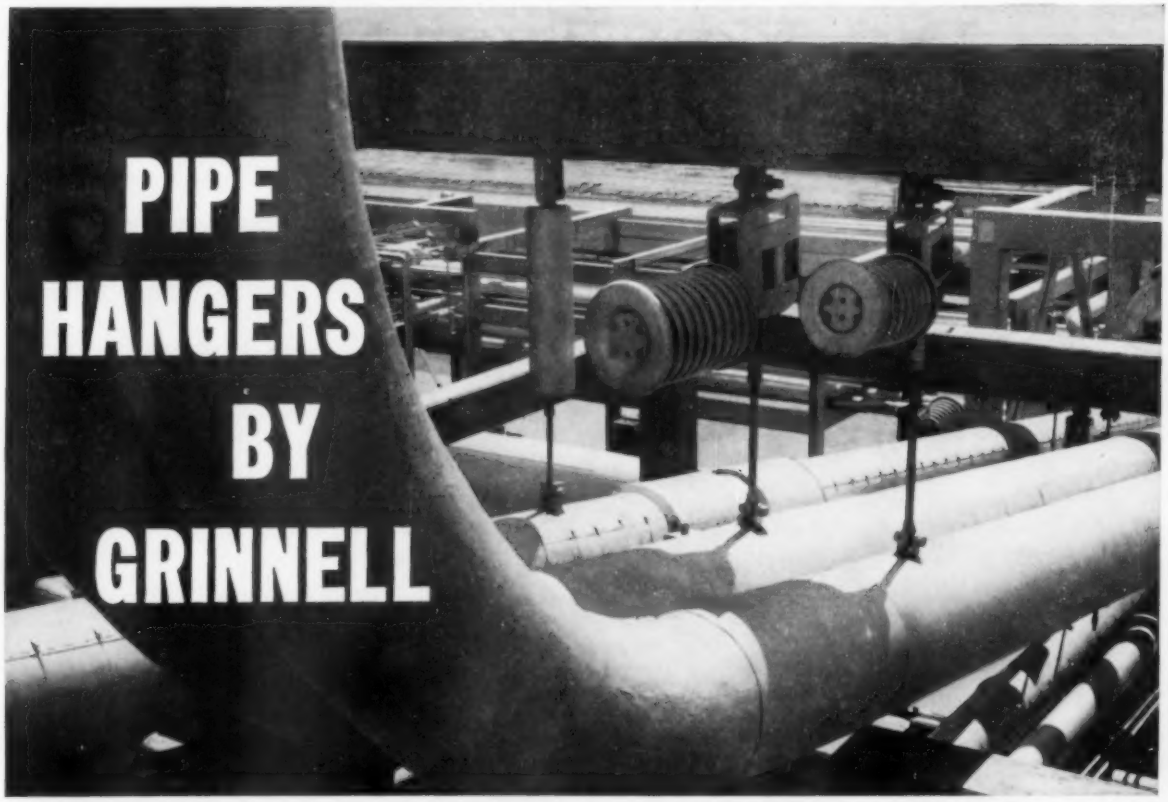
5952

OLIN MATHIESON CHEMICAL CORPORATION

ORGANIC CHEMICALS DIVISION

OLIN MATHIESON CHEMICAL CORPORATION
ONE PARK AVENUE, NEW YORK 16, NEW YORK

At Tidewater's new Delaware Refinery...



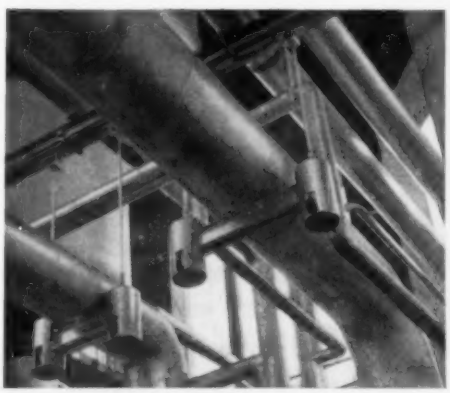
Tidewater Oil Company's new ultramodern $200-million, 5000-acre refinery, south of Wilmington, is the largest ever constructed at one time. Capable of processing 130,000 barrels of crude oil daily, the Delaware Refinery boasts eleven major processing units, including six of world-record size.

Pipe suspension problems, too, were bigger and more challenging at this record-breaking refinery. That's why Tidewater turned to Grinnell, America's #1 supplier of pipe hangers and supports.

A volume producer of pipe hangers, Grinnell backs up its high capacity and diversification with an efficient coast-to-coast network of warehouses and jobbers. Even complex hanger requirements very often can be met with hanger assemblies right off the shelf. This not only saves you time, but it can save you money, by cutting down on the number of special items which must be manufactured.

If you have a pipe suspension problem, you are invited to write: Grinnell Company, Inc., 256 West Exchange St., Providence, Rhode Island.

GRINNELL CONSTANT-SUPPORT HANGERS are engineered to maintain full safety factor. Constancy of support is mathematically perfect for all positions of travel. Note low headroom requirement. Load ranges from 30 lbs. to 32,260 lbs., with travels up to 12 inches.



GRINNELL VARIABLE SPRING HANGERS have precompression feature which assures operation of spring within its proper working range. Maximum variation in supporting force per ½" of deflection is 10½% of rated capacity — in all sizes. Available in 21 sizes for loads ranging from 50 lbs. to 28,200 lbs.

GRINNELL

AMERICA'S #1 SUPPLIER OF PIPE HANGERS AND SUPPLIERS

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic fire protection systems • Amco air conditioning systems

Did You Ever See a Double Headed Pump?

This unusual installation is operated by Low-Cost Utility Electric Power

Pumping from different depths but through the same casing, these pumps can be operated simultaneously or singly. Each is operated by AUTOMATICALLY CONTROLLED push-button power – ELECTRIC POWER.

While such installations are not common, it is standard procedure in most fields today to utilize Utility Electric Power because of the overall LOWER COST, greater efficiency, and numerous special benefits.

For helpful counsel on how you can benefit, call the Power Engineer of your Utility Electric Service Company.

I'm LCP – Low-Cost Power ON THE JOB – 24 HOURS DAILY.

PETROLEUM ELECTRIC POWER ASSOCIATION

P. O. BOX 35006 DALLAS, TEXAS

Monsanto can provide you *special blends* of phosphorus-bearing organic compounds for your gasolines.

Since research now confirms that a phosphorus additive will reduce spark plug fouling, pre-ignition and power loss, Monsanto will be happy to work with you on the phosphorus compound of your choice.

Monsanto can supply over a score of phosphorus-bearing compounds in gasoline-soluble form. Any one of these—or a blend of two or more—might provide the best control of engine deposits for your particular stocks. Since no industry-wide "standard test" for evaluating this type of gasoline additive has yet been adopted, Monsanto would be happy to work with you in your screening of phosphorus compounds under the conditions of your own evaluation.

MONSANTO CAN SUPPLY PHOSPHORUS IN A VARIETY OF GASOLINE-SOLUBLE FORMS

. . . at the lowest cost to you . . . from plants that are built and operating . . . based on a half-century of organic chemical technology . . . from a basic position as the world's largest producer of elemental phosphorus.

Your inquiries are invited.

MONSANTO CHEMICAL COMPANY
Petroleum Chemicals Department
Lindbergh & Olive Street Roads
St. Louis 24, Missouri

Monsanto®

"NOW-WE CAN BE SURE!"

Pump Buyers are saying this about Peerless Process Pumps—

PEERLESS PUMPS

Putting Ideas to Work

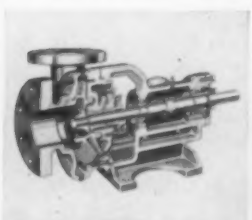
fmc FOOD MACHINERY AND CHEMICAL CORPORATION

Peerless Pump Division

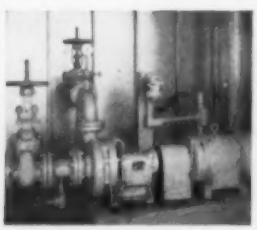
Plants: LOS ANGELES 31, CALIFORNIA and INDIANAPOLIS 8, INDIANA

Offices: New York, Atlanta, St. Louis, Phoenix, San Francisco, Chicago, Fresno, Los Angeles, Plainview and Lubbock, Texas, Albuquerque. Distributors in Principal Cities. Consult your telephone directory.

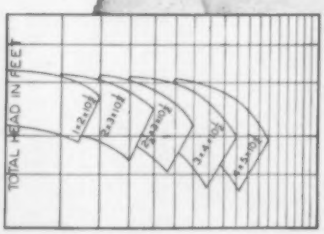
HERE ARE 4 CONVINCING REASONS WHY:



THEY OFFER the type of quality construction that measures up to any standard. Continual checking at every stage of manufacture guarantees the buyer performance he can count on in the field. *The best!*



THEY PROVIDE the performance you expect and pay for, backed by actual operating records of Peerless pumps in installations like yours. Durability, dependability, efficiency—*all proved in service.*



THEY MEET *exactly* every pumping requirement, handle any job in your system that calls for a pump. The *complete* Peerless range offers *all* types of chemical process pumps, in *all* sizes and frames.

AN EXAMPLE of Peerless research is this recently released bulletin on the effects of radial loads in process pumps, "MECHANICAL CONSIDERATION IN PUMP DESIGN." Request Bulletin No. EM-79.

Looking for Line Pipe?

Ask for Beth-Co-Weld at Bethlehem Supply Stores

When stocks of line pipe need replenishing, put in a call for Beth-Co-Weld—a pipe that's been meeting oil-country needs for many years. It's available through Bethlehem Supply stores.

A top-quality product, this sturdy steel pipe has a wide field of applications. Use it 'most anywhere—in gathering and distribution systems, storage areas, water lines around the drilling rig. If quick delivery is needed, the Bethlehem store will do everything possible to rush your order through.

The following points may help you select the proper size and type of Beth-Co-Weld for your particular job:

It meets API Spec. 5-L, and ASTM A-120 and A-53.

It is available coated, mill-wrapped, or uncoated for field wrapping.

Sizes range from ½ in. nominal through 4½ in. OD, black and galvanized, in standard weights; from ½ in. nominal through 4 in. nominal in extra-strong weights.

Sizes 3½ in. OD and 4½ in. OD are available in some weights lighter than standard.

Single mill lengths are furnished unless otherwise specified; double mill lengths can be furnished up to 50 ft in sizes 1½ in. through 4½ in. OD.

Types of ends are as follows: threaded and coupled, plain end beveled for welding, or plain end square-cut, grooved for ring-joint coupling.

BETHLEHEM SUPPLY COMPANY

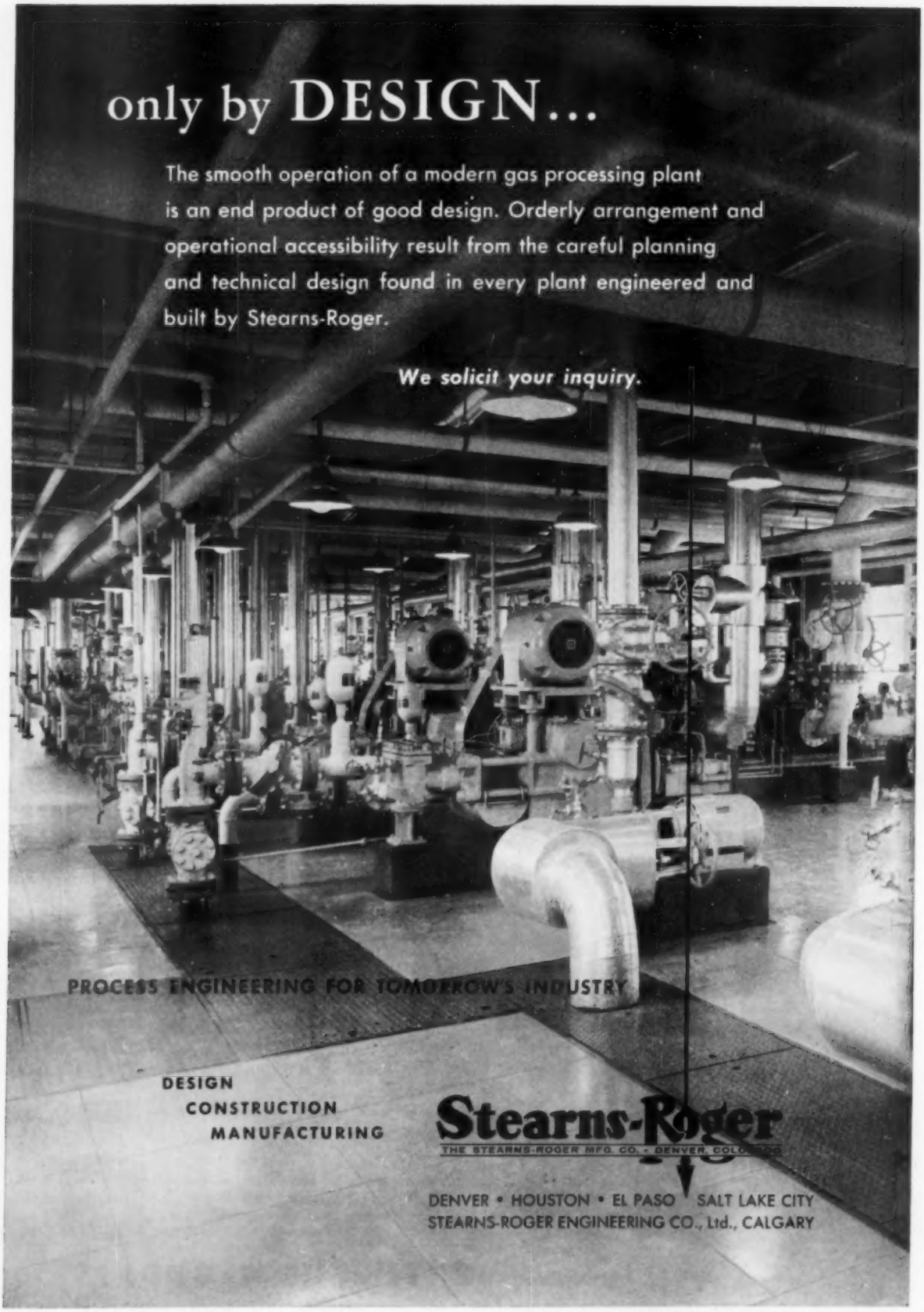
General Offices: 21 E. Second St., Tulsa, Okla.

West Coast Headquarters: Los Angeles, Calif.

Export Distributor: Bethlehem Steel Export Corporation
25 Broadway, New York, N. Y.

BETHLEHEM STEEL

BETHLEHEM SUPPLY


only by DESIGN...
The smooth operation of a modern gas processing plant is an end product of good design. Orderly arrangement and operational accessibility result from the careful planning and technical design found in every plant engineered and built by Stearns-Roger.
We solicit your inquiry.
PROCESS ENGINEERING FOR TOMORROW'S INDUSTRY
DESIGN
CONSTRUCTION
MANUFACTURING
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THE STEARNS-ROGER MFG. CO. • DENVER, COLO.
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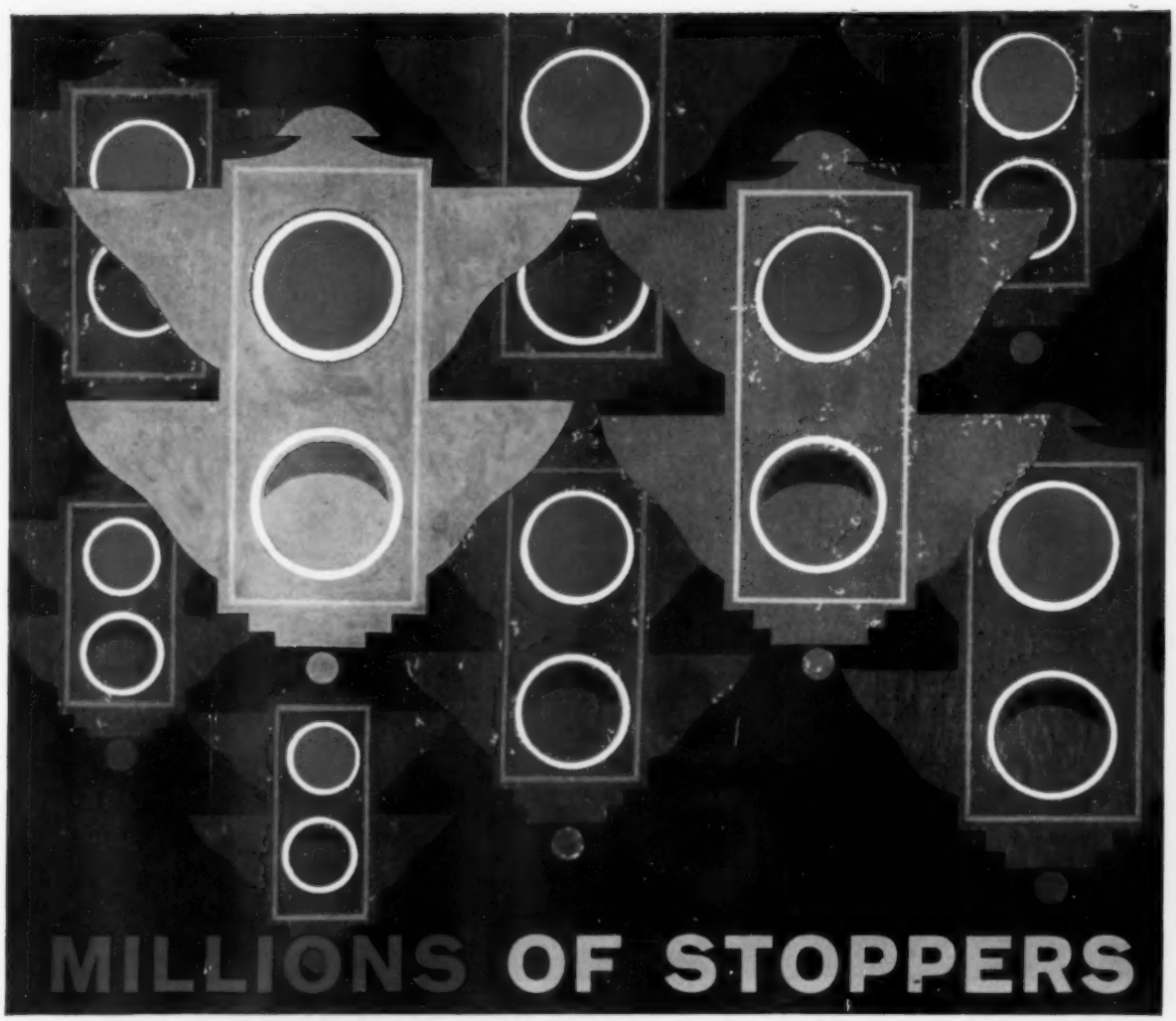
STEARNS-ROGER ENGINEERING CO., Ltd., CALGARY



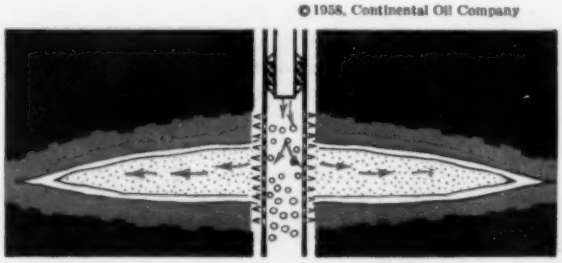
against fluid loss...thousands of feet below!

Millions of Adomite particles dispersed in a fracturing fluid act like traffic lights. They control fluid loss . . . stopping it by forming a temporary seal over pores of the rock matrix.

This allows a fracturing fluid to be injected at higher rates under greater pressures for an extended, deeper fracture . . . with minimum sanding out. After an Adomite treatment there is no evidence that the formation has ever been sealed. Consider these other important reasons why more producers are *standardizing on Adomite:*

- Obtains larger fractures per volume of treatment, or the same-sized fracture with a lesser volume of fracturing oil.
- Decreases friction loss because of the low viscosity of Adomite-treated fluids.
- Saves transportation costs — because Adomite permits you to use your own crudes.
- Assures acceptance by the pipe line companies for Adomite-treated lease crudes.

© 1958, Continental Oil Company



For greater profits
...fracture with

ADOMITE®

ACCO
for Better
Values

R-P&C VALVES

THE COMPLETE LINE
—DESIGNED FOR DEPENDABILITY

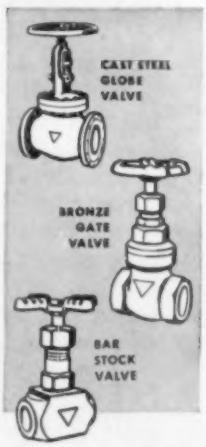
Created by R-P&C—made and sold exclusively by R-P&C...Electric Furnace Iron Valves

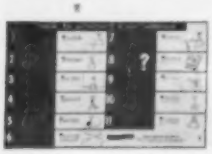
Electric furnace iron—introduced exclusively in R-P&C Valves—provides a high quality cast iron that meets the exacting requirements for pressure castings. Melted and refined under closest metallurgical supervision, R-P&C Electric Iron has physical properties *far exceeding the minimum standards* to which they must conform. It has a balanced chemical composition and a tough, dense body structure; and, it is more resistant to corrosion. All cast iron parts of R-P&C Valves are made of this Electric Furnace Iron.

Shown above is **Fig. 625**, a general service valve which is particularly applicable where full, unobstructed flow is desired. This type, available in bronze-trimmed or all-iron style, either flanged or screwed, is made in fifteen sizes, from 2″ to 24″—and is typical of the better values offered by the entire line of R-P&C Electric Iron Valves.

The R-P&C Line is Complete

The R-P&C line embraces gate, globe, angle and check valves in bronze, electric furnace iron and cast steel, and forged steel; all in a wide range of sizes, styles and pressure classes. Also, R-P&C offers specialties such as Lubrotite gate valves, bar stock valves, asbestos-packed cocks, cast steel fittings and pressure-seal cast steel valves. Order through your nearby R-P&C Distributor. For complete catalog, write our Reading office.





FREE WALL CHART
"How to Protect Your Valves"
Installation pointers, operating tips, clues to longer valve life. They are all on this 22″ x 17″ wall chart. Write for your free copy.

R-P & C VALVE DIVISION
AMERICAN CHAIN & CABLE

Reading, Pa., Atlanta, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

ACCO

ANNOUNCING the appointment of

MID-CONTINENT SUPPLY CO.

Fort Worth, Texas

as **EXCLUSIVE**

WORLD-WIDE*

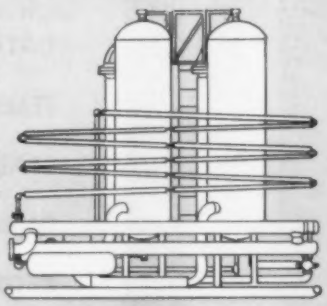
DISTRIBUTOR

of **DELTA TANK**

OIL FIELD EQUIPMENT

The complete line of Delta Tank oil field equipment . . . spherical, vertical and horizontal separators . . . heaters . . . metering equipment . . . emulsion treaters . . . low temperature extraction units . . . dehydration equipment . . . natural gas processing units . . . steel tanks . . . and other petroleum processing equipment . . . is now available to you with the advantage of Mid-Continent's in-the-field stocks and services.

For detailed information about the profitable, longer life and durability of Delta products, call your local Mid-Continent representative.



DRYEX . . . an automatic, rapid cycle adsorption process unit for extraction and recovery of hydrocarbon fractions from natural gas streams.

*Except in Mexico

DELTA TANK MANUFACTURING COMPANY, INC.

P. O. BOX 1469 • BATON ROUGE, LA.

PLANTS: BEARDSTOWN, ILL. • MACON, GA.
SALES OFFICES: HOUSTON, TEXAS • NEW YORK, N. Y.
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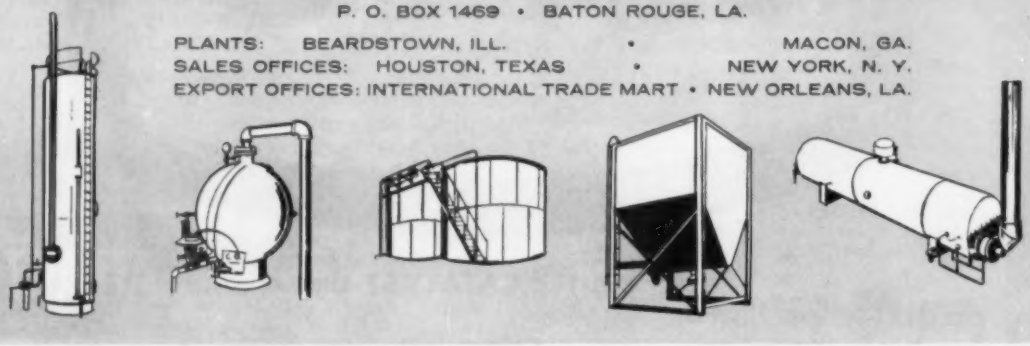


CATFORMING

YOUR LOW-COST KEY TO HIGH OCTANES

CATALYSTS — Specific type for your problems.

SELECTIVITY — Superior yield at high octanes.

STABILITY — High activity with long life.

DURABILITY — Tolerance for moisture and nitrogen.

REGENERATION — To extend normal life or recover from upsets.

For further information on Catforming, write or wire The Atlantic Refining Company, P. O. Box 8138, Philadelphia 1, Pennsylvania.

it's the **CATALYST** that counts **ATLANTIC**

News and Notes on...

Good Packing Practice

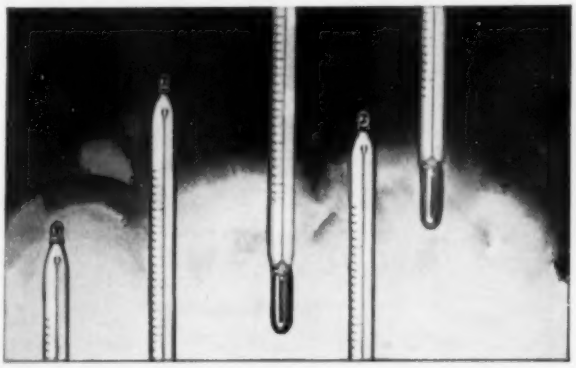
JOHNS-MANVILLE JM PRODUCTS

Maintenance and Design Hints from Johns-Manville Packings and Textiles Dept.

Subject of the month: High Operating Temperatures

Question:

What sealing materials are currently available that will match conditions brought about by higher and higher operating temperatures?



Condition 1

FOR LASTING VALVE SEALS AGAINST SUPER-HEATED STEAM AND DRY GASES

Designed to meet today's demand for a packing that will maintain a tight seal against steam and dry gases on valves working at line temperatures up to 1200F, J-M High-Temperature Valve Stem Packing, Style 397, offers the three-way protection of a heat-resistant plastic core, asbestos yarn, and Inconel wire reinforcement. For lasting protection of valve stems during storage, this efficient packing is now available with J-M No. 9 corrosion inhibitor.

Condition 2

FOR UTILITY SEALING IN GENERAL APPLICATIONS REQUIRING HEAT AND FLAME RESISTANCE

Wherever your operation calls for a utility gasketing material that withstands both heat and flame, specify J-M Asbestos Rope, Style 4200. Made of 99% pure asbestos, this material can take temperatures far in excess of other grades of rope. You'll find it a handy, reliable gasket for sealing joints between furnace doors and brickwork, boiler expansion joints, blast furnace connections, ingot moulds, and countless other uses. Ask for information about J-M Style 4200 Asbestos Rope.

Condition 3

FOR FLANGES WORKING AT TEMPERATURES TO 1600F AND HIGHER

Elevated temperatures are efficiently sealed using J-M Goetze V-Tite Gaskets. Used in flanges grooved for ring joint gaskets. Materials are available for service ranging upwards of 1600F. Controlled hardening assures correct flow of material at low bolt stress. Temperature range —320F to +1600F and higher.

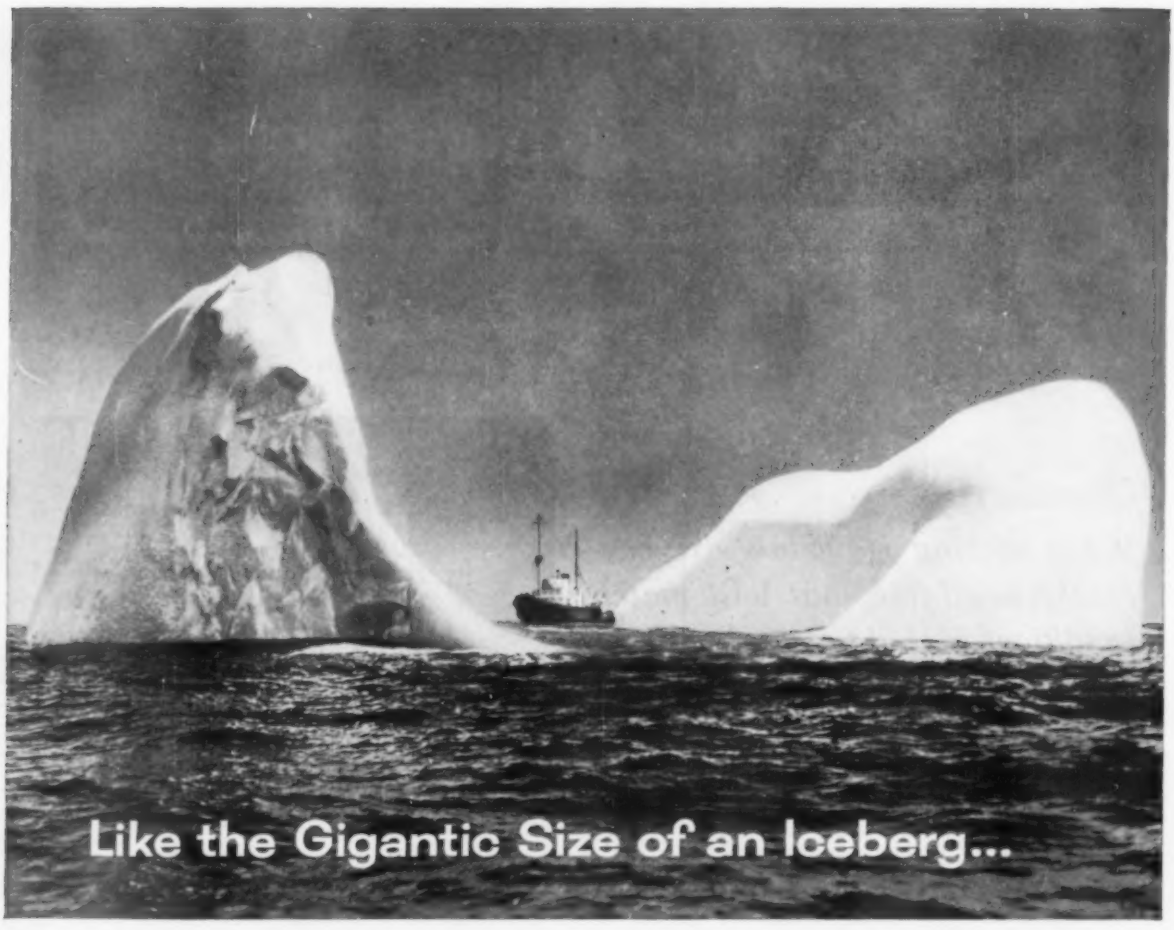
Condition 4

FOR PACKING PROBLEMS IN ANY TEMPERATURE RANGE

Your Johns-Manville field representative is a trained specialist in packing problems of all types. He's located near you, to help out whenever you need specialized packing information. For information on new packings and gaskets—for engineering and design advice—for tips on more efficient, more economical packing techniques—your Johns-Manville representative is a good man to know.

For information on any Johns-Manville Packings and Gaskets, write Johns-Manville, Box 14, New York 16, N. Y. In Canada: Port Credit, Ontario.

JOHNS-MANVILLE



there's more to Cities Service than meets the eye!

Mammoth as it may appear to the eye, an iceberg is normally eight times the size of its visible portion. Seven-eighths lies submerged and unseen beneath the surface.

Few spectacles of nature are so awesome as the iceberg. Hundreds of yards in length, it rises 100 feet or more above the sea, with crests or minarets spiring higher to 200 and even 300 feet.

Yet, only about one-eighth of an iceberg's mass rides in view. The great bulk lies hidden in the ocean depths.

Similarly unseen by most of the public they serve are the far-flung facilities of petroleum enterprise—towering derricks in the oil fields—mighty refineries—thousands of miles of pipeline—fleets of ocean-going tankers—wonderful modern laboratories.

Costly? Yes—the capital invested in the business of a major oil company such as Cities Service exceeds a billion dollars. Without these facilities and the skilled men and women who operate them, the American petroleum job could not be done... and petroleum, next to food, is America's most vital product today.

CITIES SERVICE

ANOTHER FIRST FROM TUBE TURNS...

LIGHT WEIGHT FITTINGS for lower-cost piping

Light weight piping makes practical the use of larger pipe for greater flow area, and it cuts cost and weight. To enable you to take full advantage of the economies of "thin wall" steel piping, Tube Turns offers a complete line of light weight fittings. TUBE-TURN* Light Weight Welding Fittings are produced under the same exacting quality control standards as the 12,000 other items in the Tube Turns' line. They are available promptly from your nearby Tube Turns' Distributor.

(*continued on next page*)

TUBE TURNS

A DIVISION OF NATIONAL CYLINDER GAS COMPANY

Louisville 1, Kentucky

*"TUBE-TURN" and "tt" Reg. U. S. Pat. Off.

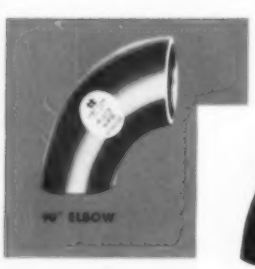
Available in nominal sizes from 4" through 24" . . . in wall thicknesses of .188, .219 and .250 inch. Also, 125 lb. light weight taper face welding neck flanges in sizes 2"—12" inclusive.

How you can cut costs with

TUBE-TURN® LIGHT WEIGHT WELDING FITTINGS

A typical user of light weight steel piping reports these benefits: 100 feet of 8" x .188" wall pipe costs about $10 less than 100 feet of 6" standard weight pipe • Increases flow area 85% • Cuts piping weight about 10% • To enable you to take full advantage of these economies, Tube Turns offers a complete line of light weight fittings. They are forged from seamless pipe. Meet all code requirements. Uniform wall thickness and true circularity permit field cutting of odd angles. Available promptly from Tube Turns' Distributors in all principal cities. Complete details in Bulletin TT 867, free on request.

The trademarks "tt" and "TUBE-TURN" are applicable only to the quality products of Tube Turns.



Available from your nearby TUBE TURNS' Distributor

TUBE TURNS
224 East Broadway, Louisville 1, Kentucky

Please send free copy of Bulletin TT 867 on Light Weight Fittings and Bulletin TT 821 on Taper Face Flanges.

Company Name _____

Company Address _____

City _____ Zone ___ State _____

Your Name _____

Position _____

TUBE TURNS

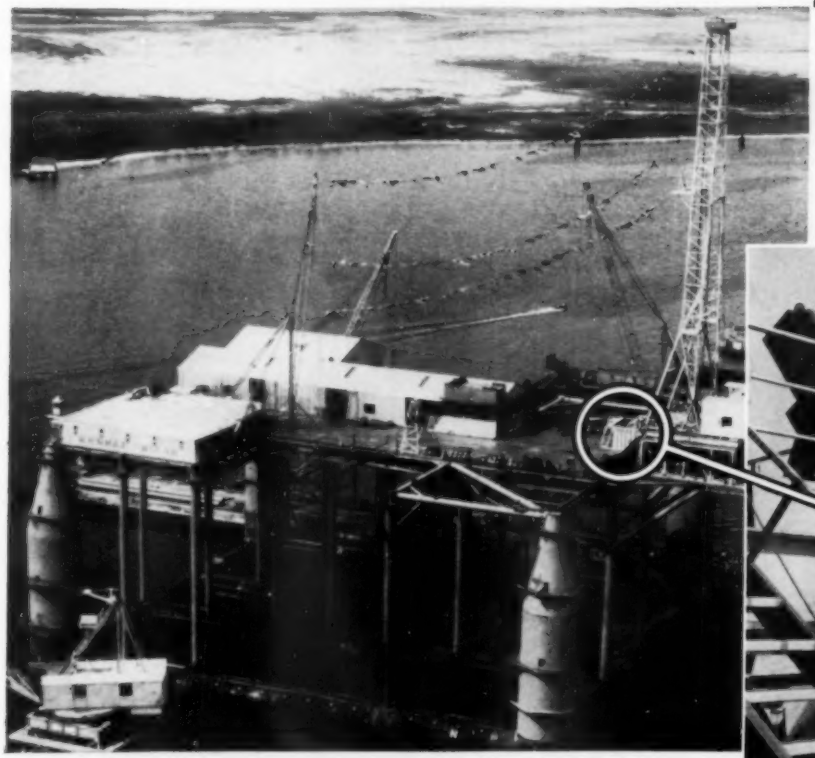
A DIVISION OF NATIONAL CYLINDER GAS COMPANY

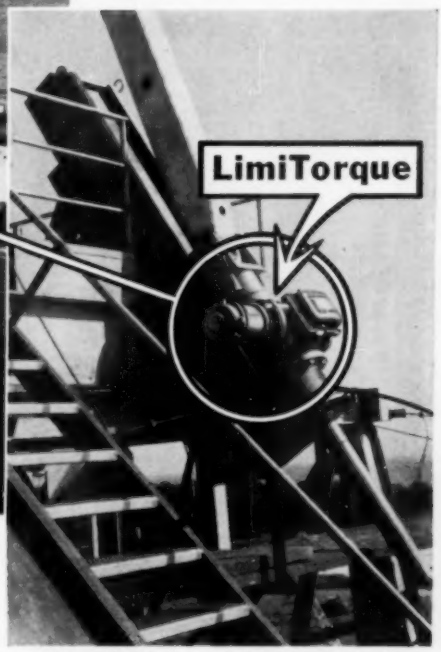
Louisville 1, Kentucky

DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Chicago Detroit • Atlanta • New Orleans • Houston • Midland • Dallas • Tulsa Kansas City • Denver • Los Angeles • San Francisco • Seattle

In Canada: TUBE TURNS OF CANADA LIMITED, Ridgetown, Ontario DISTRICT OFFICES: Toronto, Ontario • Edmonton, Alberta • Montreal, Quebec • Vancouver, B. C.

LimiTorque ACTUATORS ENABLE DRILLING MAST TO SERVE AS CONSTRUCTION BOOM . . . . . on "KERMAC" RIG 46, SUBMERSIBLE BARGE





Jacks on derrick legs, electrically operated by LimiTorque actuators, allow the mast to be tilted for use as a construction boom, which can pick up 250,000 lbs. from the water.

Kerr-McGee Industries' modern Rig 46 Submersible Barge is the widest and longest mobile offshore structure yet built . . . width 202 ft., length 242 ft., and when floating with its Drilling Mast up, it is the tallest floating structure of any kind anywhere—from bottom of base to top of Drilling Mast it is 268 ft. high. The use of two LimiTorque Motorized Actuator Units permit the Drilling Mast (designed by IDECO) to "tilt", and thereby act also as a Construction Boom. Construction of this unique Submersible Barge was done at the Ingalls Shipbuilding Corporation, Pascagoula, Miss. . . . Rig 46 is entirely self-contained and is towed to location by tugs.

THIS APPLICATION OF LIMITORQUE LINEAR POSITIONING CONTROLS IS UNIQUE AND EFFECTIVE—AND MAY SERVE AS A SUGGESTION FOR OTHER USES IN THE PETROLEUM INDUSTRY.

LimiTorque Motorized Linear Positioning Actuators and Valve Operators are backed by 30 years experience; they are highly efficient and absolutely dependable.

Send for catalog L-550

LimiTorque®

PHILADELPHIA GEAR WORKS, INC.
ERIE AVE. & G STREET, PHILADELPHIA 34, PENNA.
Offices in all Principal Cities

INDUSTRIAL GEARS & SPEED REDUCERS • LIMITORQUE VALVE CONTROLS • FLUID MIXERS • FLEXIBLE COUPLINGS

Limitorque Corporation • Philadelphia

For

LONGER

well life...

HALLIBURTON CEMENTING

Casing a well is a major expense in drilling. Your casing job requires a good cementing job which is designed to:

- protect and conserve possible oil productive zones until they are ready to be tested or produced
- preclude migration of water, oil or gas from one formation to another
- protect casing from corrosive waters
- reduce danger of contamination of potable water
- control high or low pressure zones encountered

Moreover, a cementing job by Halliburton aids in providing a base for fracturing, squeeze cementing and future workover for the life of your well.

HALLIBURTON

OIL WELL CEMENTING COMPANY

DUNCAN, OKLAHOMA

"TARGET-SEEKING" PRODUCTS FOR BETTER CEMENTING BY HALLIBURTON

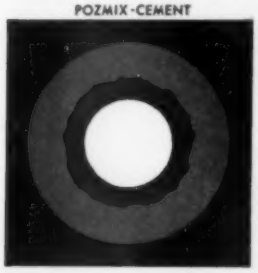
SUPER-SEAL FLOATING EQUIPMENT

Halliburton's Super-Seal Float Collar and Float Shoe "float" and guide casing string into bore hole. Also reduce possibility of contamination around outside of bottom joints. Super-Seal Floating Equipment has more than twice the sealing area of usual ball-and-seat valves, aiding positive shut-off against back pressure.

"DV" MULTIPLE-STAGE CEMENTER

For primary cementing on outside of casing string. "Targets" of Application for this versatile tool include full-depth cementing, cementing off formations at any point, reducing channeling, reducing pump pressures, dual zone well completion, and preventing loss of cement slurry to thief formations. Designed for positive fluid shut-off by means of hydraulically operated dual sleeves and high-pressure packing. Tested for strength to withstand pressures up to collapsible strength of casing with which used.

POZMIX-CEMENT

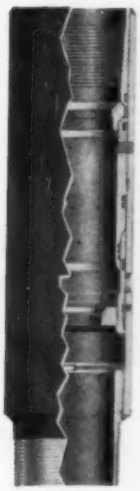


POZMIX-CEMENT

Halliburton's high-performance cement is superior to conventional portland cements.... it is resistant to sulfate and salt water corrosion. Pozmix-Cement is also lower in cost, easier to pump, easier to perforate, less permeable, more durable. Has been used with greater success in thousands of cementing jobs. Wide variety of accelerators, retarders, fluid loss and weight control additives provide precision control and excellent results for the widest range of cementing problems.

SUPER-SEAL FLOAT COLLAR

SUPER-SEAL FLOAT SHOE



"DV" MULTIPLE-STAGE CEMENTER

CEMENTING SERVICES

284 SERVICE CENTERS — JUST MINUTES AWAY FROM YOUR WELL

He's Ready to Hammer Out Anything You Give Him

When this photograph was taken in the Bethlehem drop-forge shops, the operator was pounding out an order of steam-trap bodies. Right after he finished, there was another job waiting for him to handle. It bore no relation to steam-trap bodies, nor did the forgings he made in the several weeks that followed. No two jobs were alike.

A Bethlehem forge-shop man is prepared for all designs. He's ready for anything. Once in action, he makes those hammers and presses dance, and they dance to his tune. He's a man who knows his craft.

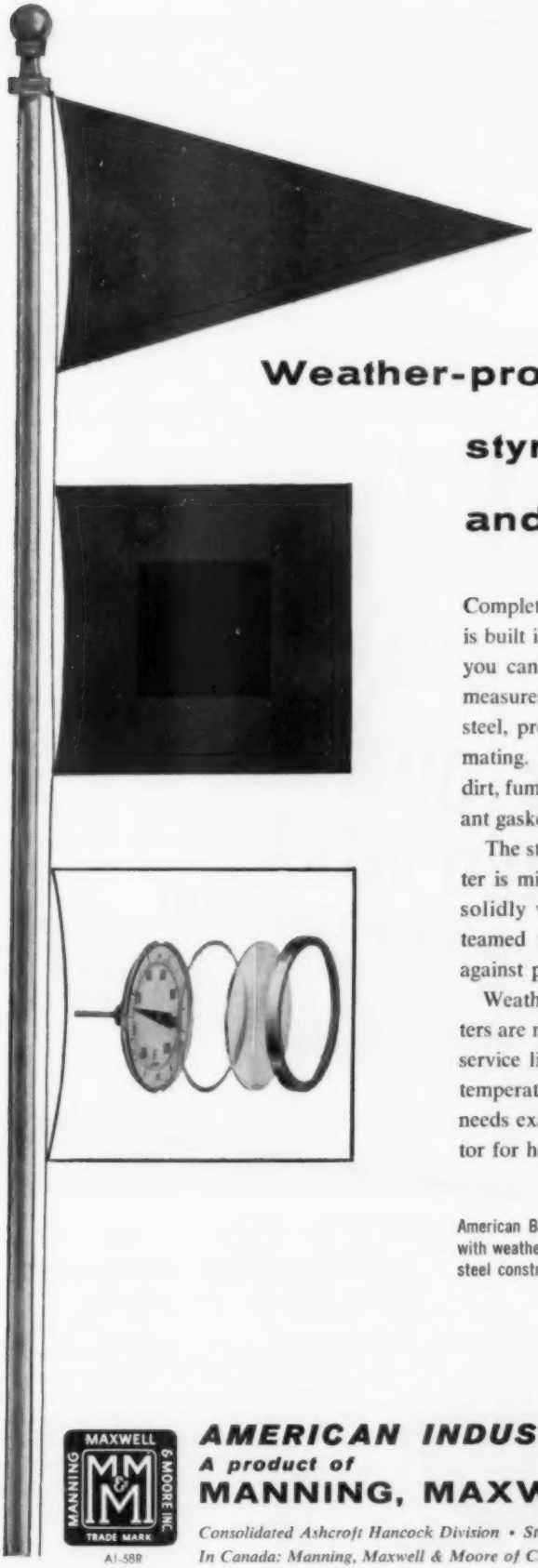
That's one of the reasons why Bethlehem closed-die forgings are unexcelled anywhere. Other vital factors are quality steel, an alert metallurgical service, and first-class treating and inspection facilities. All of these Bethlehem has. Whenever you need closed-die forgings ranging from one to 250 lb, we suggest you call us. We'll cooperate fully.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL



Weather-proof construction stymies erosion and corrosion

Complete protection against erosion and corrosion is built into American Bi-Metal Thermometers, so you can always be sure of accurate temperature measurement. Both case and bezel are stainless steel, precisely fitted and gasketed to insure snug mating. Whatever the weather, rain, sand, dust, dirt, fumes and frost are sealed out by a heat-resistant gasket between case and thick cover glass.

The stem of the American Bi-Metal Thermometer is mirror-smooth stainless steel. All joints are solidly welded. Top resistance to corrosion is teamed with strength, rigidity and tight closure against process pressures.

Weather-proof American Bi-Metal Thermometers are noted for high sustained accuracy and long service life. There are mounting styles, dial sizes, temperature ranges and stem lengths to meet your needs exactly. Ask your industrial supply distributor for help in proper selection.

American Bi-Metal Thermometer with weather-proof stainless steel construction.

MAXWELL MANNING M&M & MOORE INC. TRADE MARK

A1-58R

AMERICAN INDUSTRIAL THERMOMETERS

A product of

MANNING, MAXWELL & MOORE, INC.

Consolidated Ashcroft Hancock Division • Stratford, Connecticut

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Now!

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EXCLUSIVE DISTRIBUTOR WORLD WIDE*

OF DELTA OIL FIELD EQUIPMENT

MANUFACTURED BY

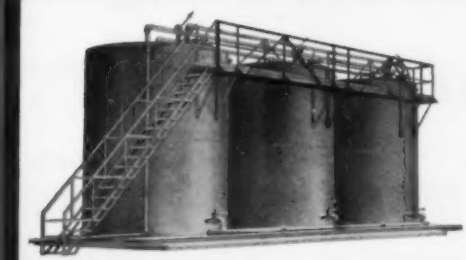
DELTA TANK MFG. CO., INC.

BATON ROUGE, LOUISIANA

*EXCEPT IN MEXICO

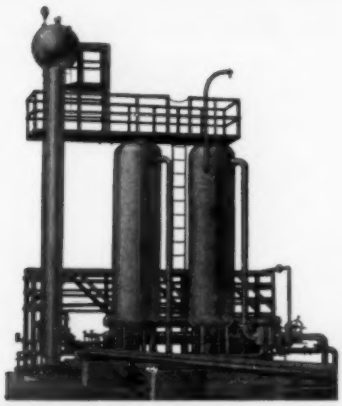
MID-CONTINENT DISTRIBUTES THESE DELTA PRODUCTS:

Full line of Steel Tanks (Bolted and Welded), Heaters, Metering Equipment, Spherical, Vertical and Horizontal Separators, Emulsion Treaters, Low Temperature Extraction Units, Dehydration Equipment, Natural Gas Processing Units and other Petroleum Processing Equipment.



DELTA STEEL TANKS

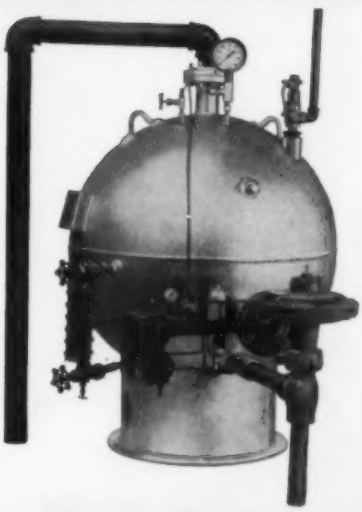
In all standard sizes and for all oilfield requirements.



DELTA DRYEX* UNIT

An automatic, self contained, skid mounted, rapid cycle adsorption process unit for extraction and recovery of hydrocarbon fractions from natural gas streams.

*Patented.

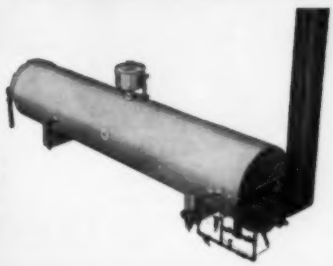


DELTA SPHERICAL SEPARATOR

Their patented interior design, proven in the laboratory and in the field, assures maximum separation and capacity. Available for high or low pressure service.

DELTA EMULSION TREATER

These vertical treaters are offered in a full range of sizes.



DELTA INDIRECT

Offered in a variety of sizes to

Delta products for the oil field will now be distributed through Mid-Continent's world-wide sales and service facilities. Addition of this top-quality line is another example of Mid-Continent's continuing policy of providing the oil industry with *complete* in-the-field stocks and service. For detailed information about how you can profit from the long life and durability of Delta products, call your local Mid-Continent representative.

MID-CONTINENT SUPPLY COMPANY

MID-CONTINENT BUILDING • FORT WORTH, TEXAS

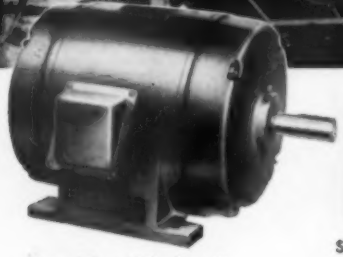
Export Division: 45 Rockefeller Plaza, New York 20, N. Y. Cable: MIDCUMPORT NYK

THE WORLD'S LARGEST INDEPENDENT OIL FIELD SUPPLY COMPANY

These Wagner Motors are designed to

Cut Operating Costs

in the oil fields

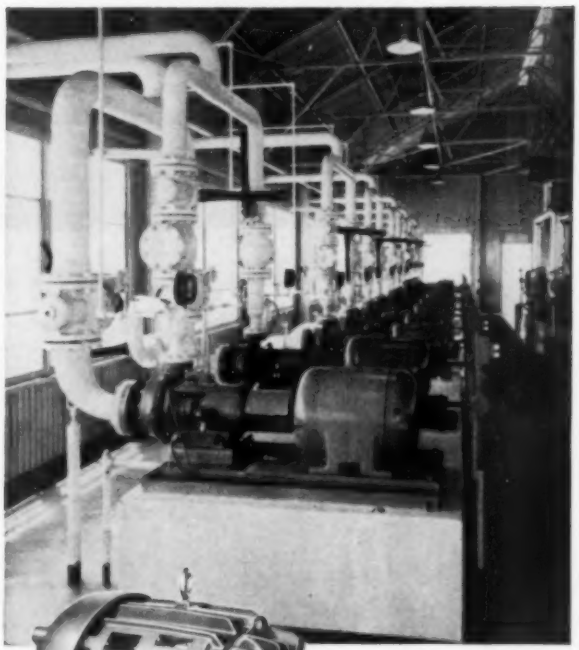


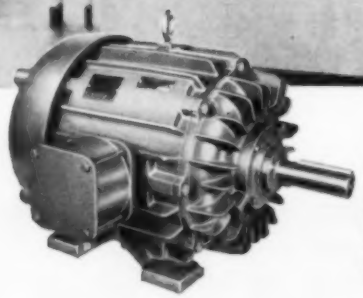
Type DP or DY oil well pumping motor. Single phase or polyphase.

Separate weatherproof control box, for use with single phase motors.

Wagner oil well pumping motors are especially designed for cost-cutting year round, maintenance-free, rugged outdoor service. They are protected against rain, sand, snow, by an enclosure that is completely dripproof—virtually splashproof. They are protected against corrosion by cast iron frames and endplates. Conduit boxes are moistureproof and dust-tight. They are available from stock in your immediate area for either polyphase or single phase operation. Single phase motors are of the high power factor capacitor start and run type with a separate weatherproof control box that contains the starting and running capacitors and voltage relay.

in the refinery





Type JP, Explosion-proof, totally-enclosed polyphase motor. Available in ratings through 250 hp.

You cut costs when you install Wagner Type JP Explosion-proof motors in your refinery because these totally-enclosed motors have extra protection that means longer motor life with little maintenance—the vital parts of the motor are sealed against the entrance of dust, fumes and moisture that are the causes of most motor maintenance problems. These motors are approved for Class 1, Group D hazardous locations, and can be used indoors or in exposed outdoor locations where corrosion is a problem. Totally enclosed fan-cooled motors are available in ratings through 400 hp.

For full information, write for Bulletins MU-132 and MU-137, or phone a nearby Wagner branch.

Wagner Electric Corporation
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WM50-3

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ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

Stopping the winch during the loading of a draw works shows the kind of strain a Mack B-80 is built to take day in and day out. Mrs. Gibson, shown above, is president and active manager of Hoot Gibson Trucking Company, an oil-field hauler in Oklahoma City.

How a woman succeeds as an oil-field trucker!

"I depend upon Macks," says Mrs. Gibson when asked to account for her success as an oil-field trucker. "My husband, who founded this business, put his faith in getting the best to do the most economical job. Since his death, I have carried on in the same manner.

"This is challenging, heavy-duty hauling, often under really adverse conditions. Hub-deep mud, roadless terrain, or over-the-road . . . we have found that Macks do the best job . . . working at top operating economy with a minimum of down time. Our performance and maintenance records prove the superiority of Macks."

Hoot Gibson's records prove it . . . and your records will, too, when you use Macks. Why not see your Mack representative for all the facts on the most complete line of heavy-duty trucks available today. Mack Trucks, Inc., Plainfield, New Jersey. In Canada: Mack Trucks of Canada, Ltd.

MACK

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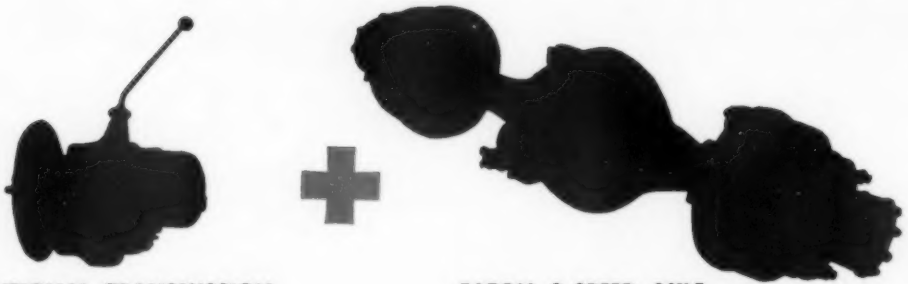

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This Combination can Save Hundreds of Dollars on Investment and Hauling Costs!

It's the BEST and LOWEST COST Combination Providing 8 or 10 Forward Speeds

- Lower total weight—permits handling as much as 200 pounds additional payload
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More than Two Million Eaton Axles in Trucks Today. For complete information, see your truck dealer.

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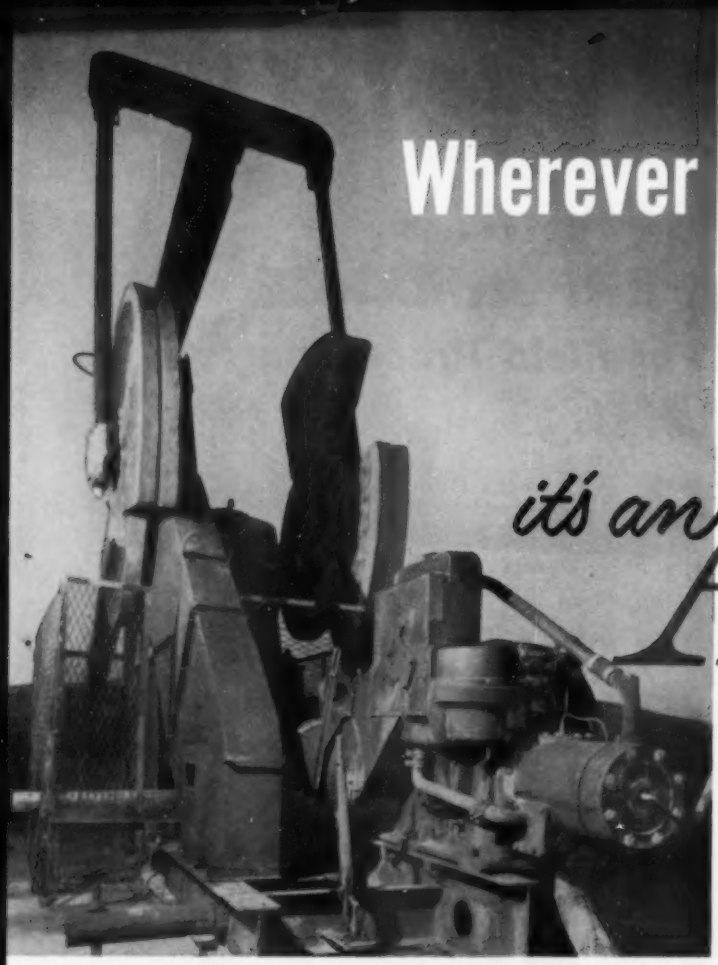

Wherever GAS ENGINES spin...

if it's willing,
able and
everlastingly dependable

it's an **Ajax** *right enough*

AJAX GAS ENGINES offer the outstanding combination of precisely-engineered simplicity, quality manufacture, smooth performance and long continuous operating life . . . in the industry's most complete gas engine line.

Eight engine sizes, ranging from 12 to 115 usable horsepower, bracket every engine power requirement of the oil producer. In every model, you get the economy *topping any other prime mover* that pays for the engine time after time throughout its useful life.

You can be sure you're "right enough"—when you specify AJAX. See your Supply Man!

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Builders of GAS AND OIL ENGINES, PRESSURE PUMPS, STEAM ENGINES

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For Field Processing!

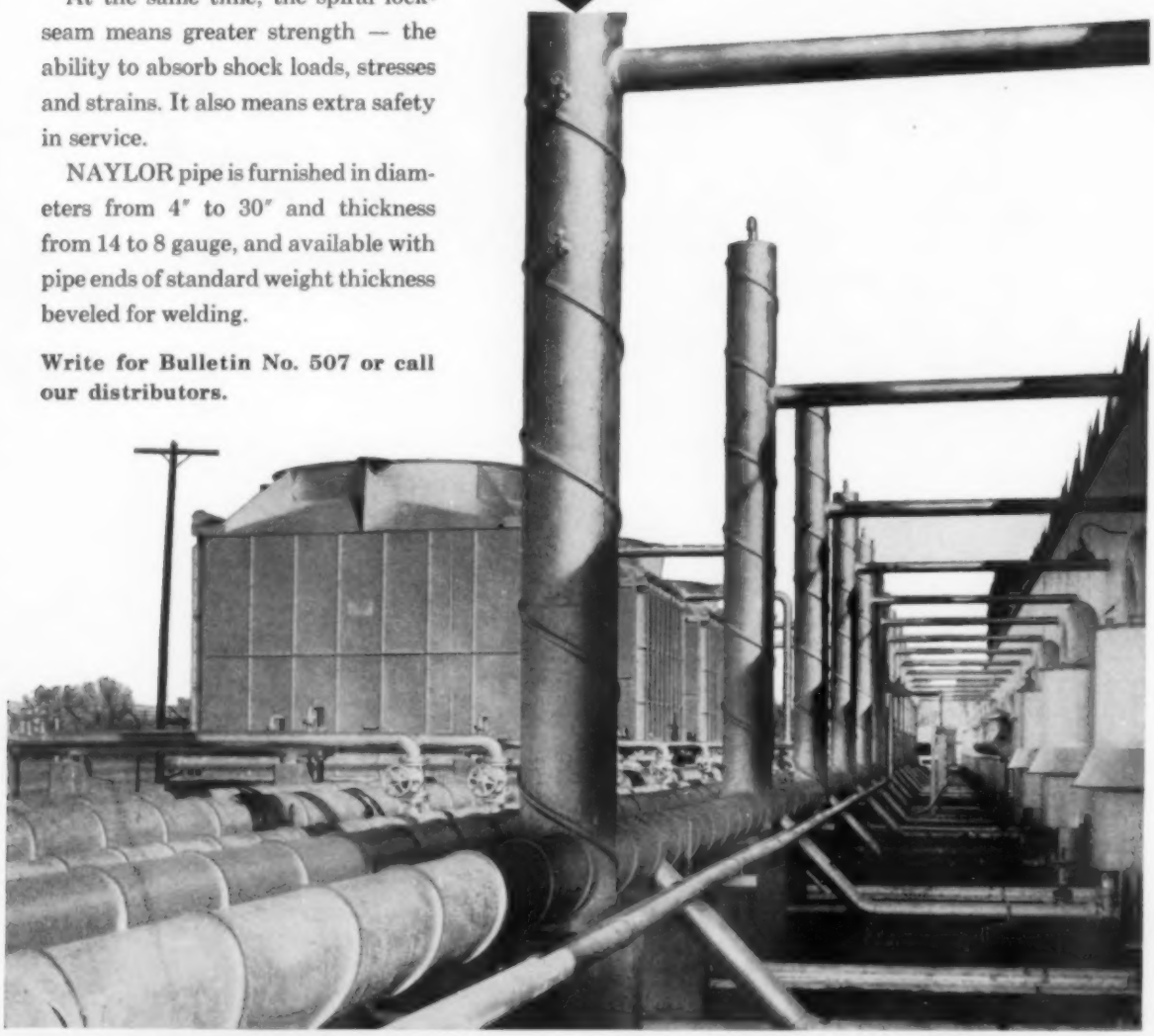
There is promise of extra performance in every spiral of NAYLOR Spiralweld pipe.

This distinguishing characteristic tells you that NAYLOR pipe is light in weight . . . easier and more economical to handle and install.

At the same time, the spiral lockseam means greater strength — the ability to absorb shock loads, stresses and strains. It also means extra safety in service.

NAYLOR pipe is furnished in diameters from 4" to 30" and thickness from 14 to 8 gauge, and available with pipe ends of standard weight thickness beveled for welding.

Write for Bulletin No. 507 or call our distributors.



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NAYLOR PIPE COMPANY

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Pipelines, trucks, tank cars are all important to the oil business. In the definite future, water will be added to the important transportation facilities utilized by the petroleum industry in Oklahoma. Equally important to oil men for almost 50 years has been the oil financing services of "The Oil Bank of America."

NBT's officers and petroleum staff are anxious to serve you. Avail yourself of these specialized financial services.

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

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THE OIL BANK
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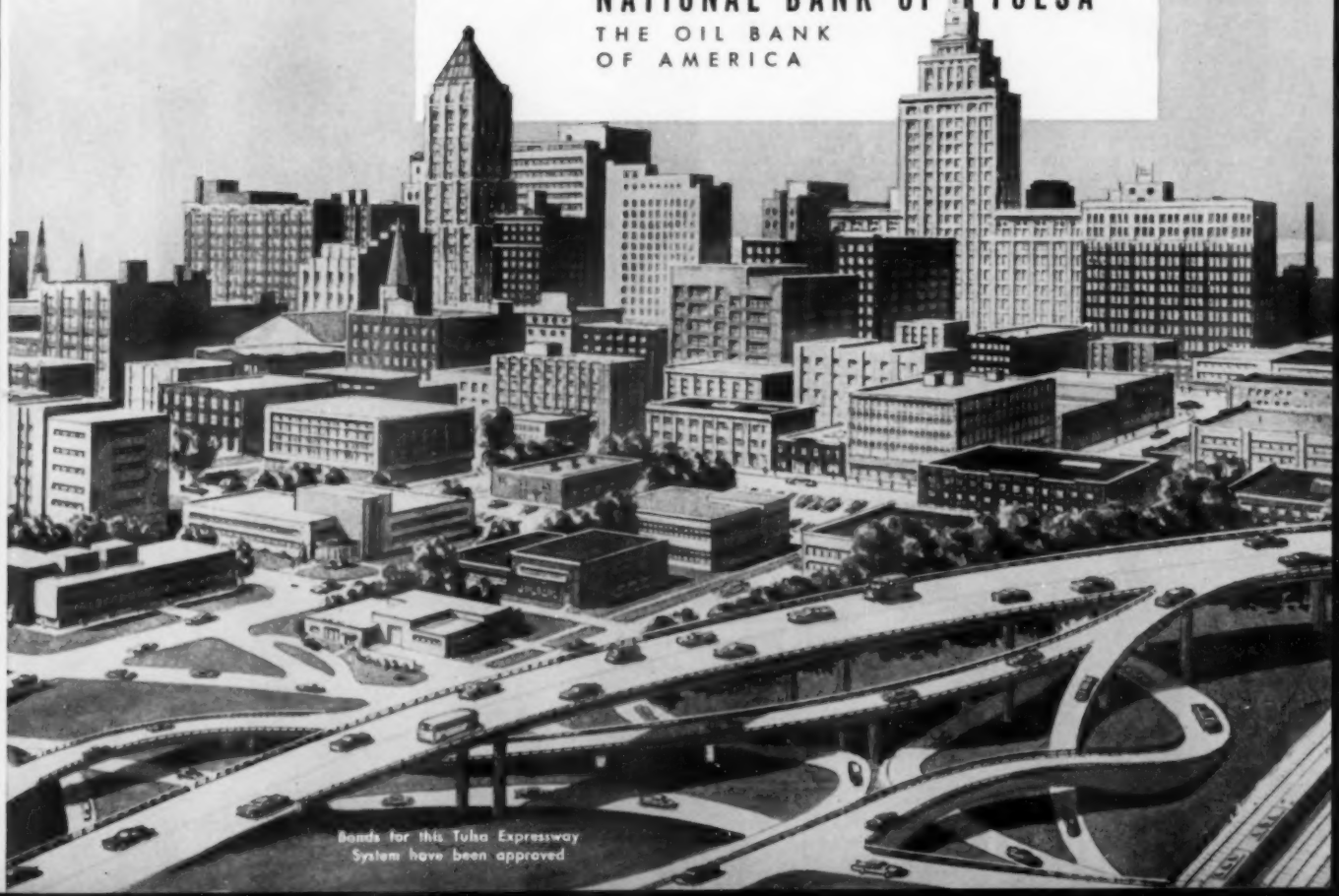
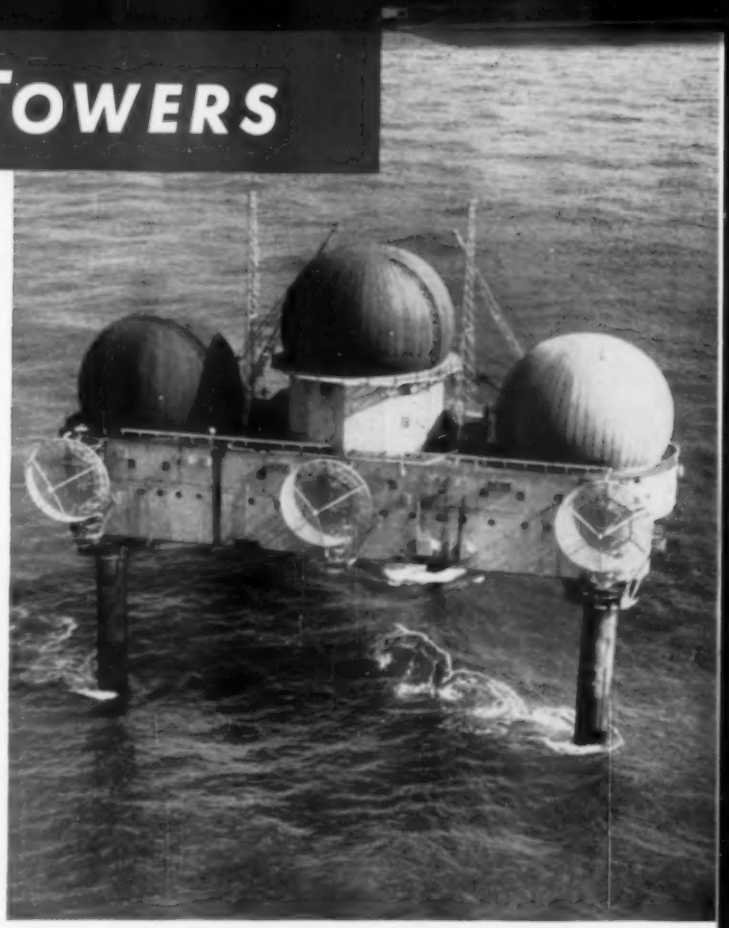


Bonds for this Tulsa Expressway System have been approved

ON TEXAS TOWERS



Wallace Process Piping Co., Inc.

Used

MIDWEST

WELDING FITTINGS

Among the unique installations for preservation of peace are the early warning radar "Texas Towers" off the Atlantic Coast. These artificial islands stilted to the ocean floor keep watch by radar. As is true of many defense projects, Midwest Welding Fittings played a significant part on Texas Towers.

Midwest Welding Fittings are found on unusual and in critical as well as routine jobs because of exceptional quality maintained by rigid standards of manufacture. Quality control is always above and beyond code requirements.

Whatever the piping job, you will find it to your advantage to use Midwest Welding Fittings. The many benefits you get by specifying "Midwest" are shown in Catalog 54. Ask your distributor or write us for a copy.

MIDWEST PIPING COMPANY, INC.

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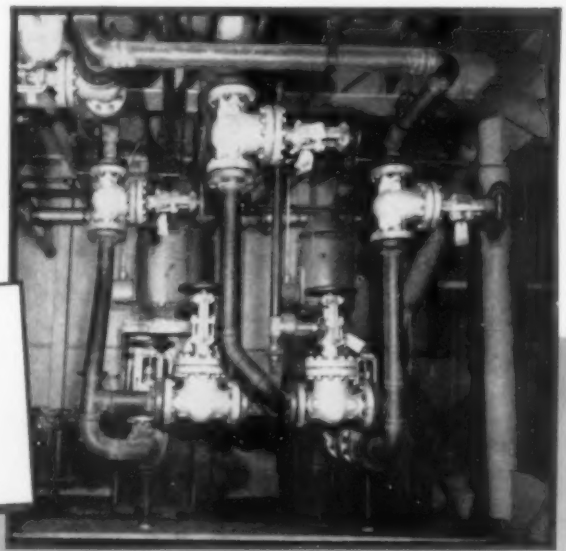


MONEY SAVED With MIDWEST "LONG TANGENT" ELBOWS

Here are the important advantages of Midwest "Long Tangents": They save pipe. They often eliminate short nipples and their extra welds. They save time and money in lining up and clamping pipe and fitting. They remove the circumferential weld from point of maximum stress and can be sleeved. Midwest "Long Tangent" Elbows cost no more than other elbows.

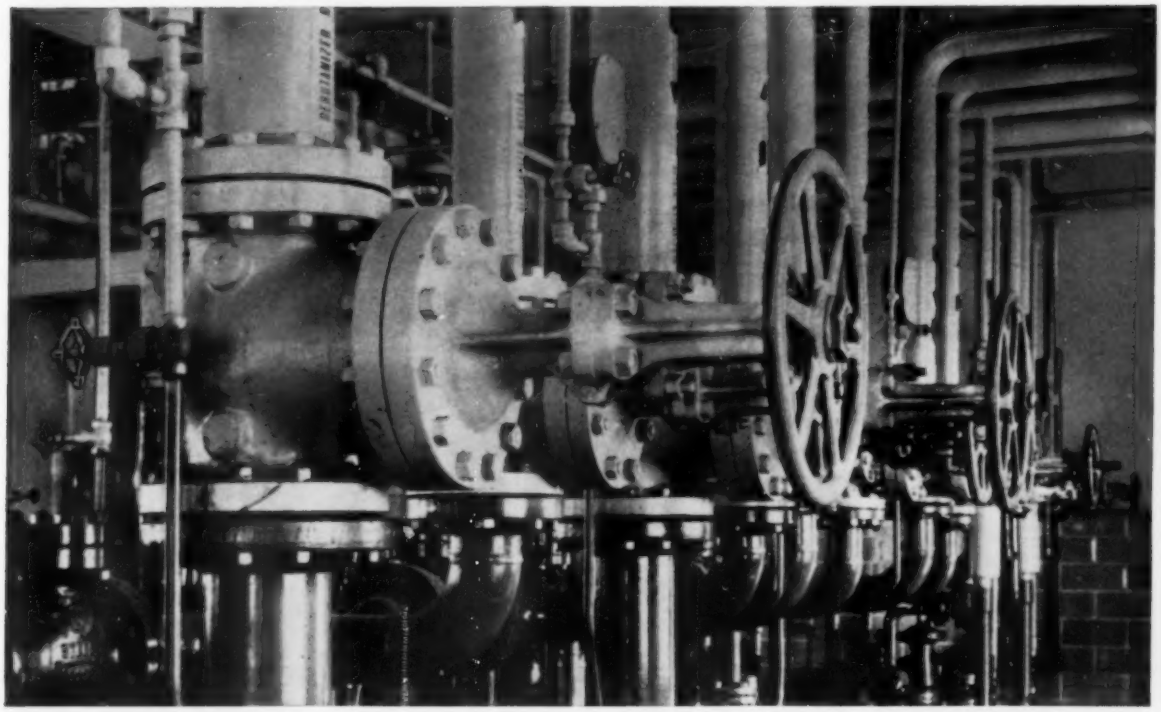
Piping on two Texas Towers was installed by Wallace Process Piping Co., Inc., as subcontractors to Steers Morrison Knudsen and Continental Copper & Steel Industries, Inc. All welding fittings were supplied by Midwest through Central Jersey Supply Co. The many advantages of Midwest "Long Tangent" Elbows were an important factor in the selection of Midwest fittings for this critical work.

7901

MIDWEST WELDING FITTINGS IMPROVE PIPING DESIGN AND REDUCE COSTS

Don't Hedge on Quality When You Buy Steel Valves...

Maintenance costs can gobble up your savings in a few months!



LUNKENHEIMER QUALITY is no longer a luxury—it's your vitally needed insurance against today's sky-high maintenance expense. Labor rates are going still higher . . . "downtime" costs are multiplying . . . repair charges are rocketing up—with no relief in sight. Today, it pays to buy the *best valves you can get*, with no hedging on quality. Your purchase of Lunkenheimer Steel Valves is an investment that pays worthwhile dividends in maintenance savings . . . year after trouble-free year. The Lunkenheimer Company, Box 360, Annex Station, Cincinnati 14, Ohio.

The cost of a LUNKENHEIMER VALVE
Gets smaller...and smaller...and smaller...
with each passing year af dependable service

A check on the cost of maintaining your cast steel valves will prove this point.

STEEL • BRONZE • IRON • PVC

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LUNKENHEIMER QUALITY

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THE ONE *Great* NAME IN VALVES

★ Viscosity
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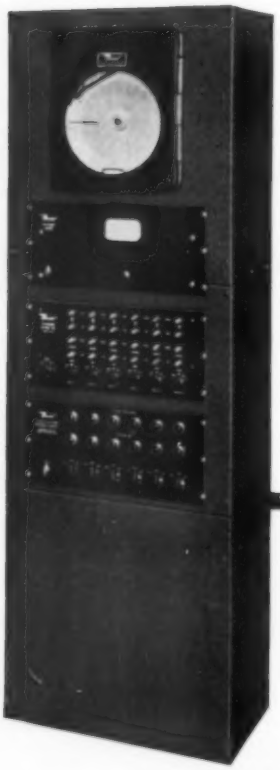
A BETTER WAY TO CONTROL EACH, AUTOMATICALLY AND CONTINUOUSLY



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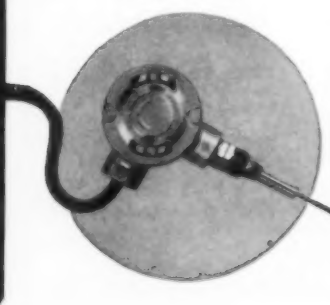
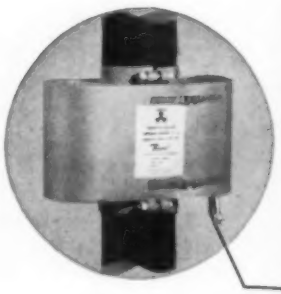
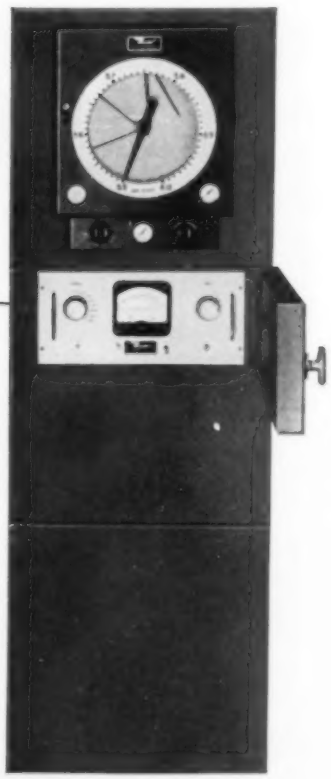
Provides continuous and automatic viscosity control of from one to six individual stations in a single system. Ranges: 0-50,000 centipoises X grams /cc. Proven uses in liquid blending, fuel atomization or refinery applications in the petroleum, chemical, steel, gravure and flexographic printing, resin, adhesives, paint finishing and various other fields. Ultra-Viscoson systems are available to fill most industrial and research requirements.

*REG. U. S. PAT. OFF.







BENDIX NUCLEAR DENSITY GAGE

Provides continuous and automatic control of fluid density in process pipelines. Range: 0.5 Sp. Gr. and up, with adjustable spans. Ideal for use with abrasive, corrosive, viscous and high-pressure processes; sensing element does not contact process material. Applications: Density, specific gravity, liquid concentration, vapor/liquid ratio, liquid level, slurry control and interface detection. Range, span and time constant adjustments from front panel.

For complete information write
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AVIATION CORPORATION

High comfort is now a business-twin reality! No more uncomfortable oxygen masks for high-altitude flying. Now—in the 4 to 6-place Alti-Cruiser—you fly at the altitude of your choice, above the weather, and enjoy the comfortable cabin pressure of an airplane flying thousands of feet lower.

No longer do you have to choose between a time-wasting flight *around* bad weather and an uncomfortable flight *through* it. In your Alti-Cruiser you fly *over* the weather to your destination—in airline comfort.

In the air or on the ground you enjoy full cabin air-conditioning, unavailable in any other executive twin. You remain fresh, ready for productive action at all times—and you always arrive *on* time.

Get the complete story. Send today for your copy of the fact-filled, illustrated brochure.

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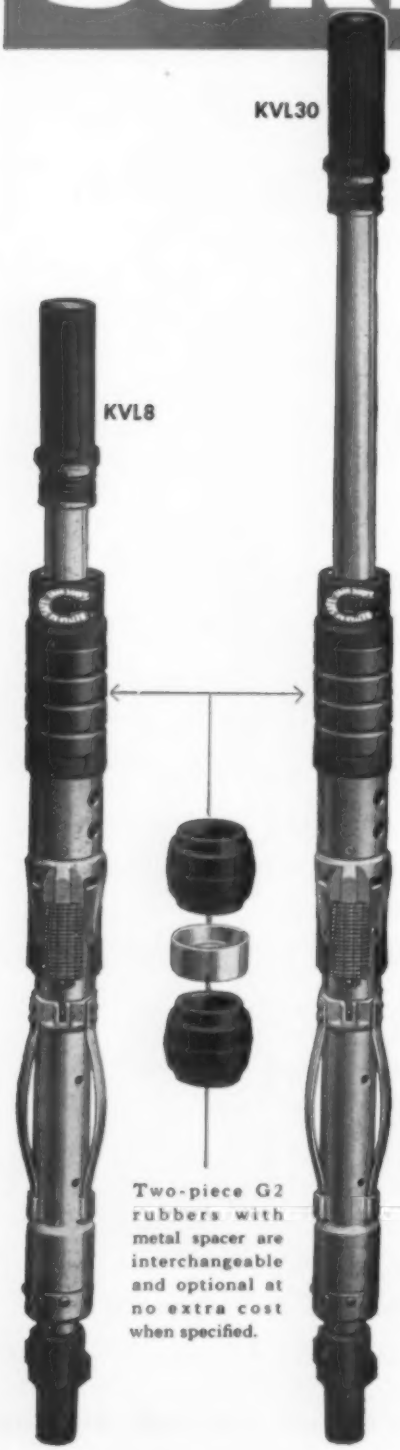
SAFE and SURE

GUIBERSON'S KVL PACKERS



Two-piece G2 rubbers with metal spacer are interchangeable and optional at no extra cost when specified.

With Automatic Latch

Operators who want extra assurance that a packer won't come unlatched going in, depend on Guiberson KVL packers. Rugged and durable, KVL packers have earned a reputation for dependable performance in deep and medium depth wells. These retrievable packers are easy to set and release, with ample bypass and positive seal. When running into a liner the KVL stays latched and drag springs provide an excellent guide — features operators like. For conserving gas energy and increasing production in flowing wells; for completing wells by circulation; for acidizing, repressuring and dozens of other uses, the KVL is unsurpassed.

- Made as the KVL30 with 30″ valve stroke or KVL8 with 8″ valve stroke for standard below-packer circulation. (Both packers also made with perforated mandrel for circulation above packer.) Available in casing sizes 5″ through 9⅝″.
- Valve has two independent sealing elements, a tapered metal valve and seat and a set of oil-resistant seal rings, affording double-sealed protection.
- Rubbers made of special oil and gas resistant compound. Will not vulcanize to casing — recover original shape when released.

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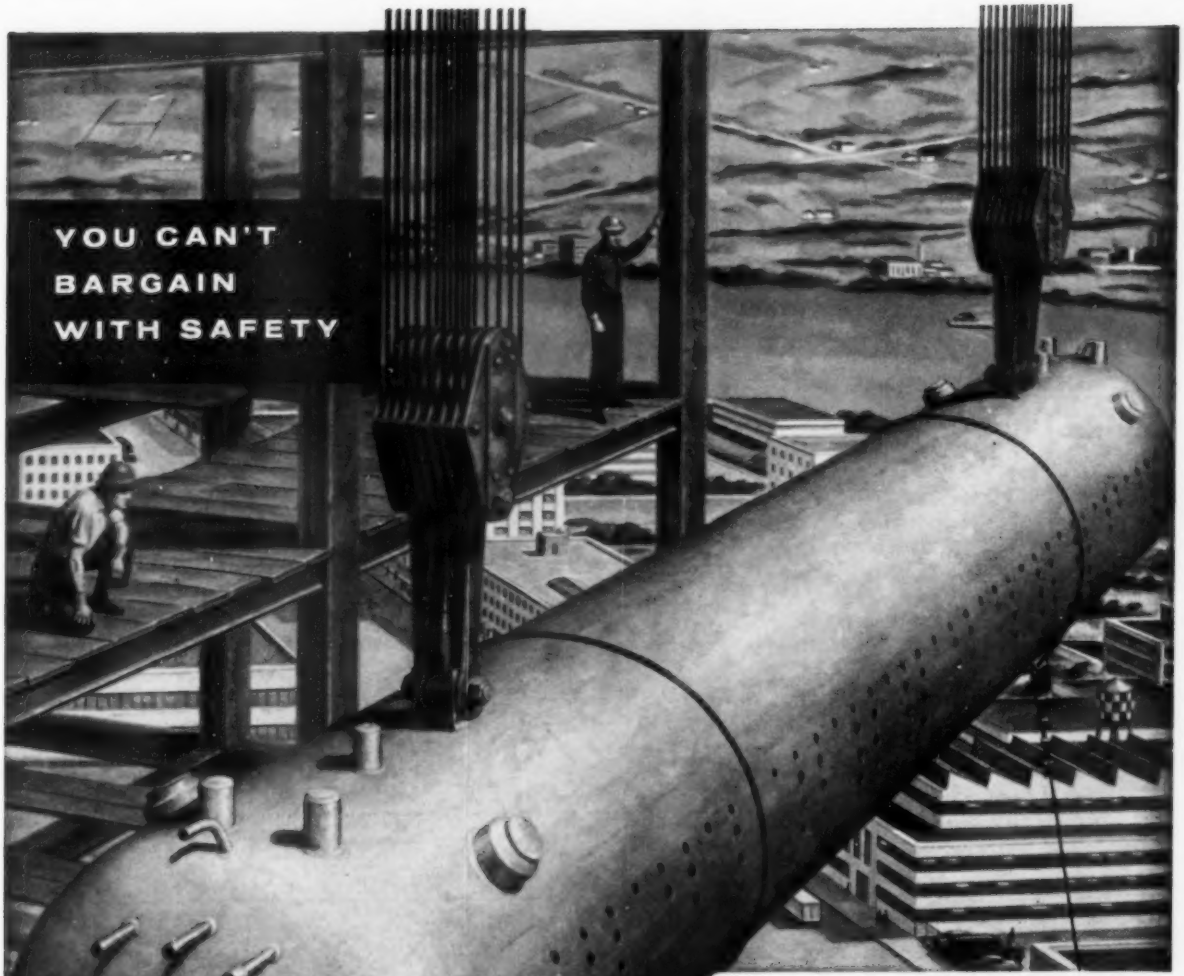
Oil Field Supply Stores
Everywhere



This 240,000-pound steam drum, built by Combustion Engineering for a large generating plant, is here being hoisted 120 feet into position by strong wire rope. It's a striking example of how . . .

safety rides on quality wire rope

You may never hoist loads as large as this 120-ton drum. But *safe, top quality wire rope is just as important to your own operations.* For, although the price of a "bargain" rope would be less, failure of such a rope could cost you thousands of dollars in wrecked equipment. Don't be a victim of false economy. Buy a wire rope that's a quality rope—buy Wickwire Rope.

5339

WICKWIRE ROPE
A CF&I PRODUCT

CF&I

LOOK FOR THE YELLOW *TRIANGLE*

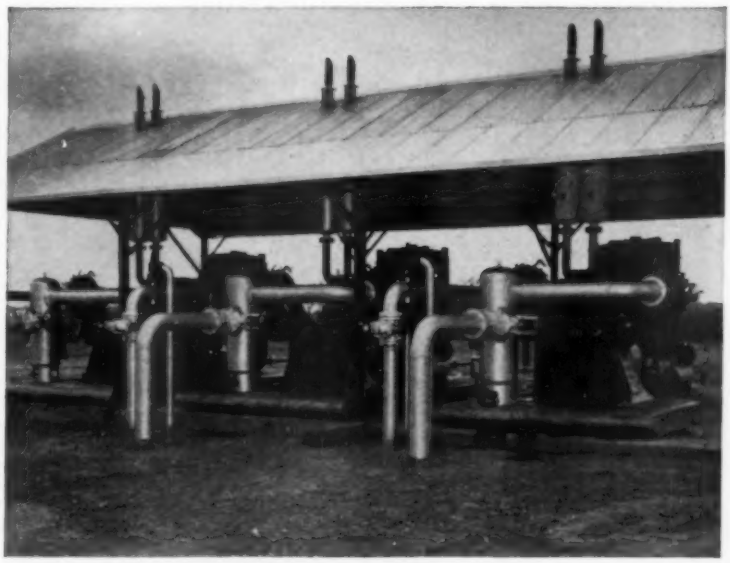
PRODUCT OF WICKWIRE SPENCER STEEL DIVISION
THE COLORADO FUEL AND IRON CORPORATION

THE COLORADO FUEL AND IRON CORPORATION—Albuquerque • Amarillo • Billings • Boise • Butte • Casper • Denver • El Paso Farmington (N. M.) • Fort Worth • Houston • Kansas City • Lincoln (Neb.) • Odessa (Tex.) • Oklahoma City • Phoenix • Pueblo Salt Lake City • Tulsa • Wichita • **PACIFIC COAST DIVISION**—Los Angeles • Oakland • Portland • San Francisco • San Leandro Seattle • Spokane • **WICKWIRE SPENCER STEEL DIVISION**—Boston • Buffalo • Chattanooga • Chicago • Detroit • Emlenton (Pa.) New Orleans • New York • Philadelphia

JOY *Packaged* GAS COMPRESSORS

THE ONLY MODERN-DESIGN COMPRESSORS FOR GAS BOOSTER OPERATION

- **Full force-feed lubrication.**
- **Field-replaceable crosshead guides.**
- **Patented Joy "Dual-Cushion" valves.**
- **Field-replaceable cylinder liners.**
- **Anti-friction main bearings.**



Joy WNB-112 Gas Compressor installation.

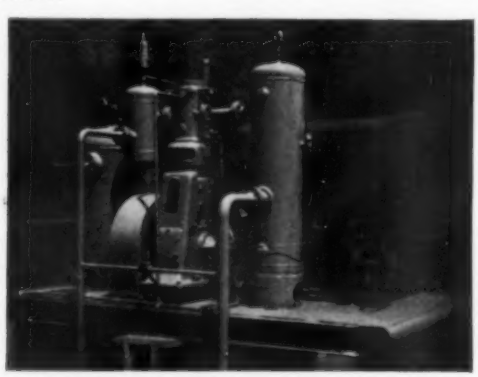
Modern Packaged Joy Gas Compressors are backed by a century-old reputation for low maintenance and long service. The time-proved features listed above make Joy Compressors the most reliable for gas gathering, repressuring, or gas lifting.

Joy Gas Compressors are available in space-saving vertical, V-type, and semi-radial designs . . . single or two-stage units with cylinder sizes from 3" to 13½". Four different frame types accommodate a power range of 50 to 400 HP.

For the most efficient compressor for your needs call a Joy Engineer or write: ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.***

In Canada:
Joy Manufacturing Company (Canada) Limited, Galt, Ontario.

Joy WNB-114 Gas Compressor unloading onto a concrete pad. Inlet pressure 5 psig; discharge 150 psig. Capacity 2MMCFD.



Joy WGB-110 Gas Compressor installation. Inlet pressure 150 psig; discharge pressure 500 psig. Capacity 1.028 MMCFD.

JOY . . . EQUIPMENT FOR OIL FIELDS . . . FOR ALL INDUSTRY

Write for FREE Bulletin 207-31

OR

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2525 San Jacinto Street

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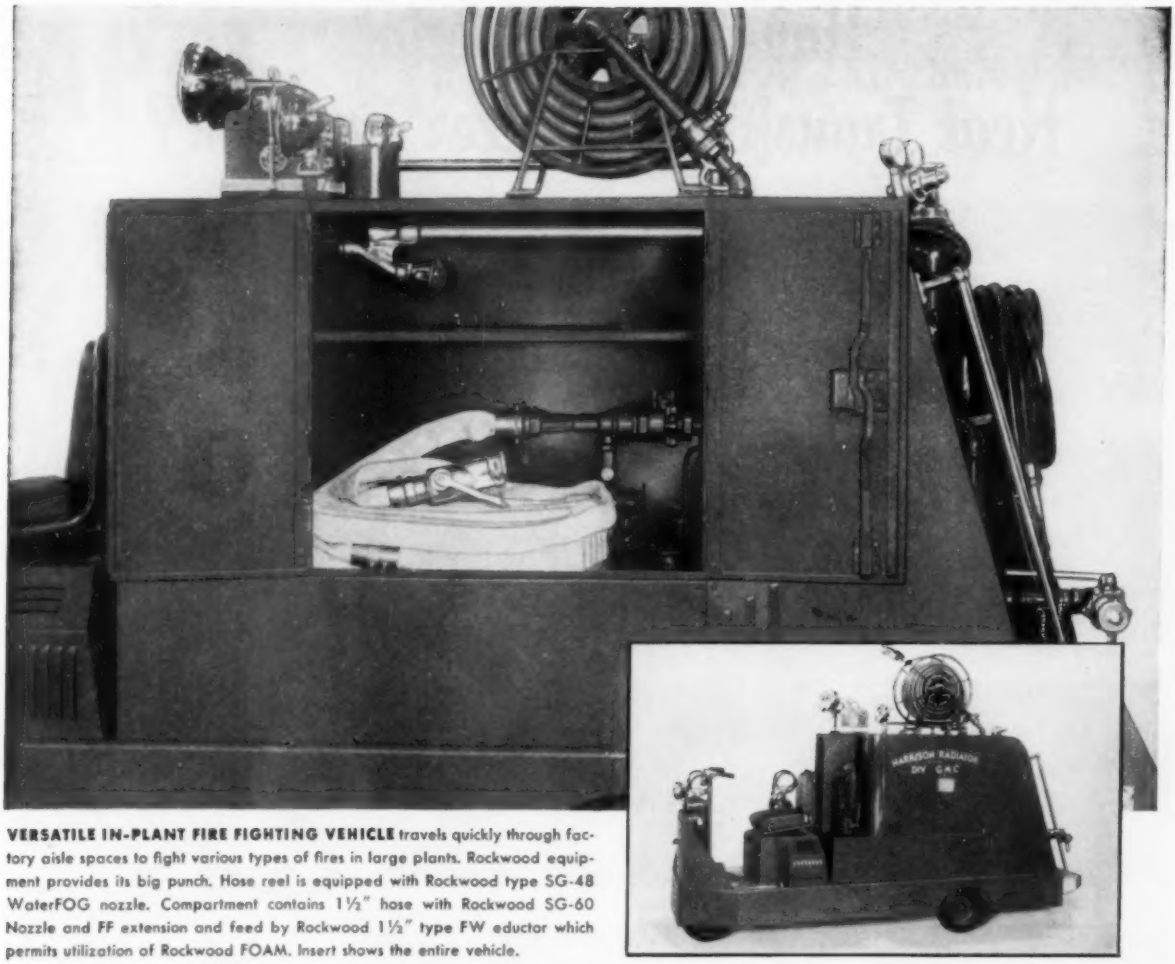
P. O. Box 868

WBW-10934-307



VERSATILE IN-PLANT FIRE FIGHTING VEHICLE travels quickly through factory aisle spaces to fight various types of fires in large plants. Rockwood equipment provides its big punch. Hose reel is equipped with Rockwood type SG-48 WaterFOG nozzle. Compartment contains 1½" hose with Rockwood SG-60 Nozzle and FF extension and feed by Rockwood 1½" type FW eductor which permits utilization of Rockwood FOAM. Insert shows the entire vehicle.

The Inside Story of the Potent "Youngster"—a New In-Plant Fire Fighter

The Young Fire Equipment Corporation of Buffalo, New York, made this vehicle an even more potent fire fighter by installing Rockwood fire prevention equipment.

Here's How It Works

Rockwood FOAM is automatically proportioned (97 parts water to three parts FOAM) and introduced into the hose line by the Rockwood FW eductor. The Rockwood SG-60 WaterFOG nozzle fights fire five ways — by means of a solid water stream high-velocity WaterFOG, low-velocity WaterFOG from applicator, and from FF extension inserted in nozzle, a wide angle FogFOAM pattern and a solid FOAM stream.

Send For Full Information

Rockwood's wide variety of fire fighting equipment is engineered to quickly, safely control fires. Fill in the coupon below now.

Tested and listed by Underwriters Laboratories, Inc. Distributors in all principal industrial areas.

ROCKWOOD SPRINKLER COMPANY

Engineers Water . . . to Cut Fire Losses

Distributors in all principal industrial areas

ROCKWOOD SPRINKLER COMPANY
Portable Fire Protection Division
2071 Harlow Street
Worcester 5, Mass.

Please send me your illustrated booklet on Rockwood fire fighting products.

Name.....

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City.....*Zone*...*State*.....

Have You a Special Heat Transfer or Chiller Problem?

My Problem Is Surface Fouling!

Vogt has the answer in the positive *flow-thru* Scraped Surface Exchanger. Surfaces are swept clean by the rotating scraper action, eliminating the headache of fouled heat transfer surfaces.

We Have A Tough Crystallization Problem!

Because Vogt Scraped Surface Exchangers maintain uniform heat transfer rates crystallization is under control at all times. The rotating blades free the crystals from the walls and they are discharged as a slurry.

Our Product Must Be Mixed As It Flows!

Chemical Processors are particularly happy with the Vogt Scraped Surface Exchanger, because the product is thoroughly mixed by the rotating scraper blades as it flows.

Our Solvents are Dangerous to Use-Expensive to Lose!

Vogt Scraped Surface Exchangers are closed, pressure-type systems which permit the use of flammable, volatile and expensive solvents with complete safety and no danger of solvent loss.

Vogt

Has the answer in its Scraped Surface Exchangers

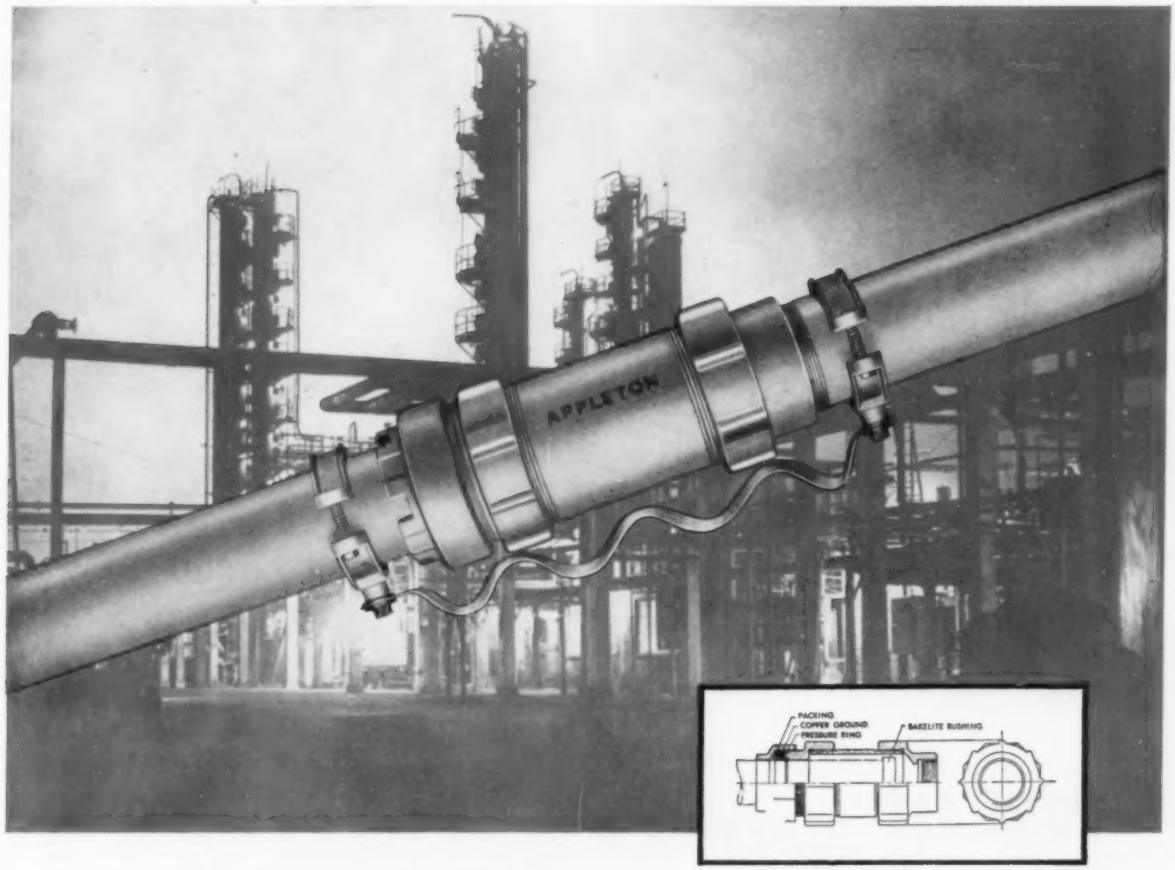
Send for Bulletin PE-1 today. Address Dept. 24AR10.

OTHER VOGT PRODUCTS: Drop Forged Steel Valves, Fittings and Flanges in a complete range of sizes • Petroleum Refinery and Chemical Plant Equipment • Steam Generators • Heat Exchangers • Ice Making and Refrigerating Equipment.

HENRY VOGT MACHINE CO., P. O. BOX 1918, LOUISVILLE 1, KY.

SALES OFFICES: New York, Chicago, Cleveland, Dallas, Philadelphia, St. Louis, Charleston, W. Va., Cincinnati

APPLETON® "XJ" Conduit Expansion Joints



Relieve the *strain* of expansion and contraction on long runs of rigid conduit

Temperature changes place a terrific strain on all long conduit runs. To relieve this potentially dangerous condition, it is best to install APPLETON "XJ" Expansion Joints at frequent intervals along the entire system. These weatherproof joints, for use with heavy-wall conduit, have a metallic packing and a bonding jumper to assure the entire conduit system remains a continuous electrical conductor. The jumper, installed in accordance with U. L. recommendations, gives double protection against extreme expansion movement reducing the effectiveness of the metallic bond.

As the conduit is inserted in the joint, a bushing is placed on the end in the manner shown. This bushing permits maximum conduit movement and yet the conduit can never pull free of the joint. The APPLETON "XJ" Conduit Expansion Joint features a metallic packing and pressure ring at the flexible end to keep the joint weatherproof at all times.

Wherever a long run conduit installation exists, the need for APPLETON "XJ" Expansion Joints exists. Interior or exterior, from Texas to Maine, temperature strains do exist, so take advantage of APPLETON'S product research program to give you the precision products you require . . . APPLETON "XJ" Weatherproof Expansion Joints for all long run conduit installations.

Sold Through Franchised Wholesalers Only

APPLETON ELECTRIC COMPANY
1701 Wellington Ave., Chicago 13

Also Manufacturers of:

COREXIT prevents sub-surface corrosion, saves up to $1,000 a year per well

Field experience shows that the use of Humble's COREXIT in pumping wells costs so little compared to the expense of well-pulling jobs and the cost of replacing broken rods, pumps and corroded tubing, that annual savings up to $1,000 per well are not unusual.

The initial COREXIT treatment cleans up your sub-surface equipment, displacing corrosive brine and loose scale from metal surfaces. Then it builds up a tenacious and lasting protective film on these cleaned metal surfaces to prevent further corrosion and hydrogen embrittlement. The continued use of a small amount of COREXIT will maintain this tough protective film. Thus COREXIT lowers your lifting costs and improves operating efficiency by prolonging the life of your equipment and reducing the number of well-pulling jobs.

COREXIT is readily available at Humble wholesale plants throughout Texas and New Mexico.

• *For complete information on COREXIT, call your nearest Humble wholesale plant in Texas and New Mexico, or phone or write:*

Humble Oil & Refining Company
Sales Technical Service
P. O. Box 2180
Houston 1, Texas

In Oklahoma & Kansas write:

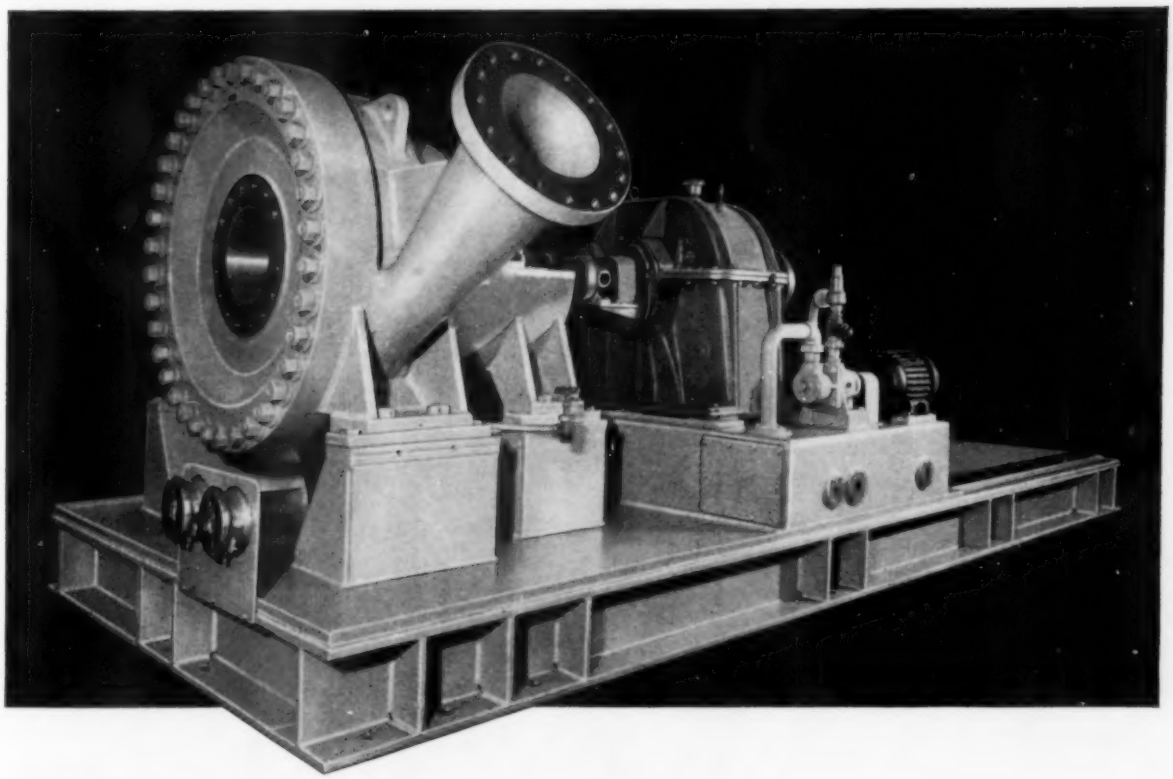
Pet-Chem, Inc.
Mayo Building
Tulsa, Oklahoma

In Illinois, Indiana & Kentucky write:

Mid-State Chemical Company, Inc.
Mt. Vernon, Illinois

HUMBLE

HUMBLE OIL & REFINING COMPANY



NEW

Single-Stage Barrel-Type
Allis-Chalmers Compressor

Boosts High Pressure Gas to Higher Pressure Levels in Range of 50 to 500 psia.

THIS new Allis-Chalmers development extends the range of single-stage compressors into high pressure levels previously handled by reciprocating type units.

The new compressor has all the advantages of a centrifugal compressor — compactness, pulsation-free operation, few wearing parts, easy maintenance.

The unit shown above, now in successful operation, boosts 3690 cfm of air from an inlet pressure of 185 psia to a discharge pressure of 240 psia. It is driven through a speed-up gear by an Allis-Chalmers 1250-hp motor.

The casing consists of three principal parts: the casing cylinder, a bolted casing head and a fabricated casing pedestal. A diaphragm which forms the gas diffuser passage is inserted into the casing cylinder. Excellent gas sealing is assured, since there is only one shaft extension and only one casing joint to seal against gas pressure.

For details, including a sectional view of this new compressor, call your nearby A-C representative, or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

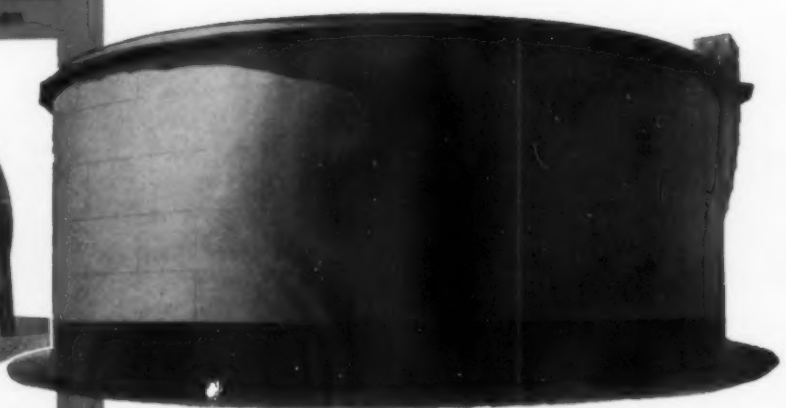
A-5728

HAMMOND

STORAGE TANKS and PLATE FABRICATION

SEALWT* tank with vapor-saver diaphragm

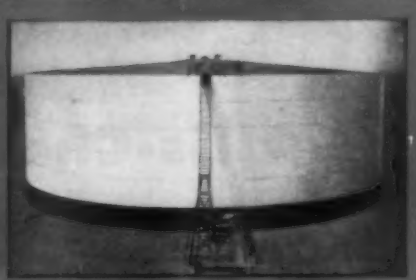
Hammond Spheres



Hammond **TUBESEAL*** and **SPRINGTITE*** Floating Roof Tanks

Process Vessels—Steel • Stainless • Alloys • Cladmetals

Water Storage Tanks



Cone Roof Tanks

The universal acceptance of Hammond-built equipment is the result of more than half a century of experience in the design, fabrication and erection of storage tanks, process vessels and steel plate construction for the petroleum, chemical and allied industries, and for water supply.

HAMMOND IRON WORKS

WARREN and BRISTOL, PA. • PROVO, UTAH • CASPER, WYO. • BIRMINGHAM, ALA.

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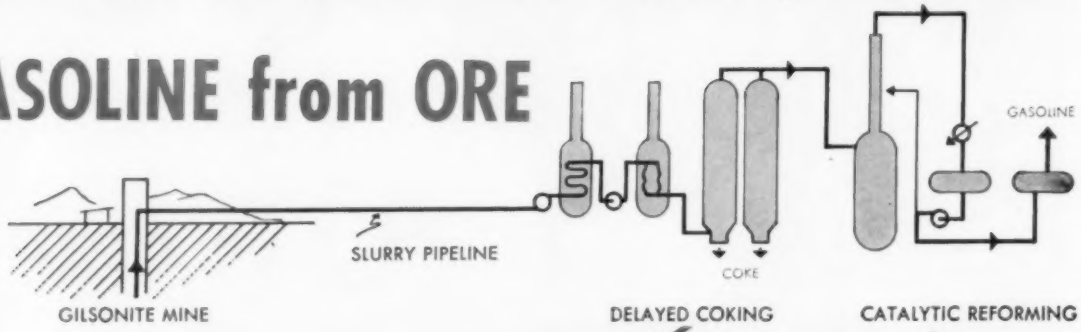
*patented

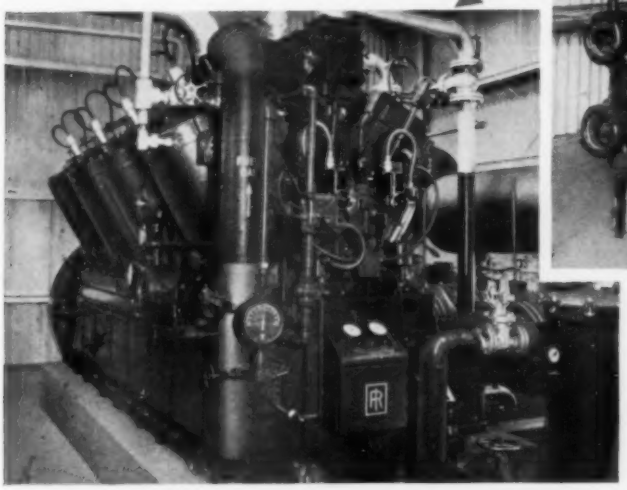
HAMONDTANK

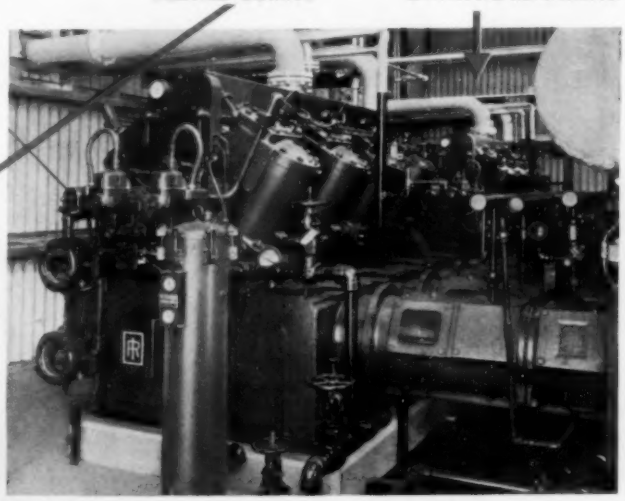
American Gilsonite's new refinery extracts

GASOLINE from ORE



Ingersoll-Rand SVG and JVG gas-engine compressors serve new process





Two Ingersoll-Rand 220-hp JVG-NL gas-engine compressors handling pure hydrogen for the catalytic reformer unit of the Gilsonite plant. The hydrogen is kept free from oil contamination by use of non-lubricated compressor cylinders with Ingersoll-Rand NL Channel Valves.

One of two Ingersoll-Rand 550-hp SVG 4-cycle gas-engine compressors handling hydrocarbon gas in the delayed coking section.

They're mining gasoline ore in Utah these days, and an old company in a new refinery is producing new products from it.

In addition to high-octane gasoline, the American Gilsonite Company* at Gilsonite, Colo., is producing high-purity electrode coke from this asphaltite ore. This ultra-modern coking and reforming plant is the nation's first to produce gasoline economically from a raw material other than crude oil, and it's doing it at the rate of 54,600 gallons a day!

Gas compression is required in both the delayed coking and catalytic reforming units, and since by-product hydrocarbon gases were available, Ingersoll-Rand gas-engine compressors were a natural selection for both jobs. The coke-producing unit, engineered by Foster Wheeler, uses two 550-hp SVG compressors; the refining unit, engineered by H. K. Ferguson, is served by two 220-hp JVG non-lubricated compressors.

In this new service as in all process plant applications, service-proved dependability and smooth operation over a wide range of speeds and loads make Ingersoll-Rand 4-cycle V-angle gas-engine compressors a profitable, long-term investment. Ask your I-R representative for more information about these and other types of equipment for petrochemical and process plants.

*An affiliate of Barber Oil Corp. and Standard Oil Co. of Calif.

Only IR compressors have CHANNEL VALVES

Known for high efficiency, quiet operation and exceptional durability. Entirely different. Each valve is a combination of straight-lifting stainless-steel channels and leaf springs, with trapped-air spaces which cushion action, prevent impact.

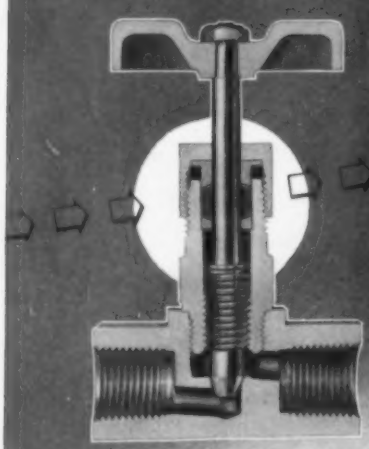
Ingersoll-Rand

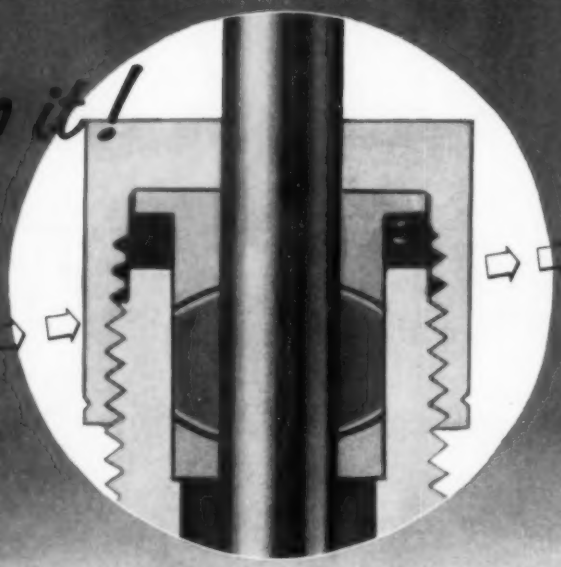
6-719 11 Broadway, New York 4, N. Y.

4-CYCLE

PUMPS • COMPRESSORS • VACUUM EQUIPMENT • GAS & DIESEL ENGINES • AIR & ELECTRIC TOOLS • ROCK DRILLS

Marsh has it!





Available in MARSH

416 Stainless Steel Needle Throttling Valves

- Body and stem guide machined from bar stainless steel stock
- Valve Stem hardened stainless
- Fine stem threads for extra strength and precision throttling
- Deeper inlet and outlet chambers
- Bodies made in accordance with MSS regulations
- Packing "Marpak" system incorporating "Teflon" as described opposite

The Marpak Packing System —*now with fabulous* "TEFLON" PACKING

An outstanding feature of the Marsh Needle Valve has been the Marpak Packing System. This unique method of obtaining a tight, but non-binding seal is one of the important reasons for the ability of Marsh Valves to give precision regulation at any pressure up to 10,000 psi.

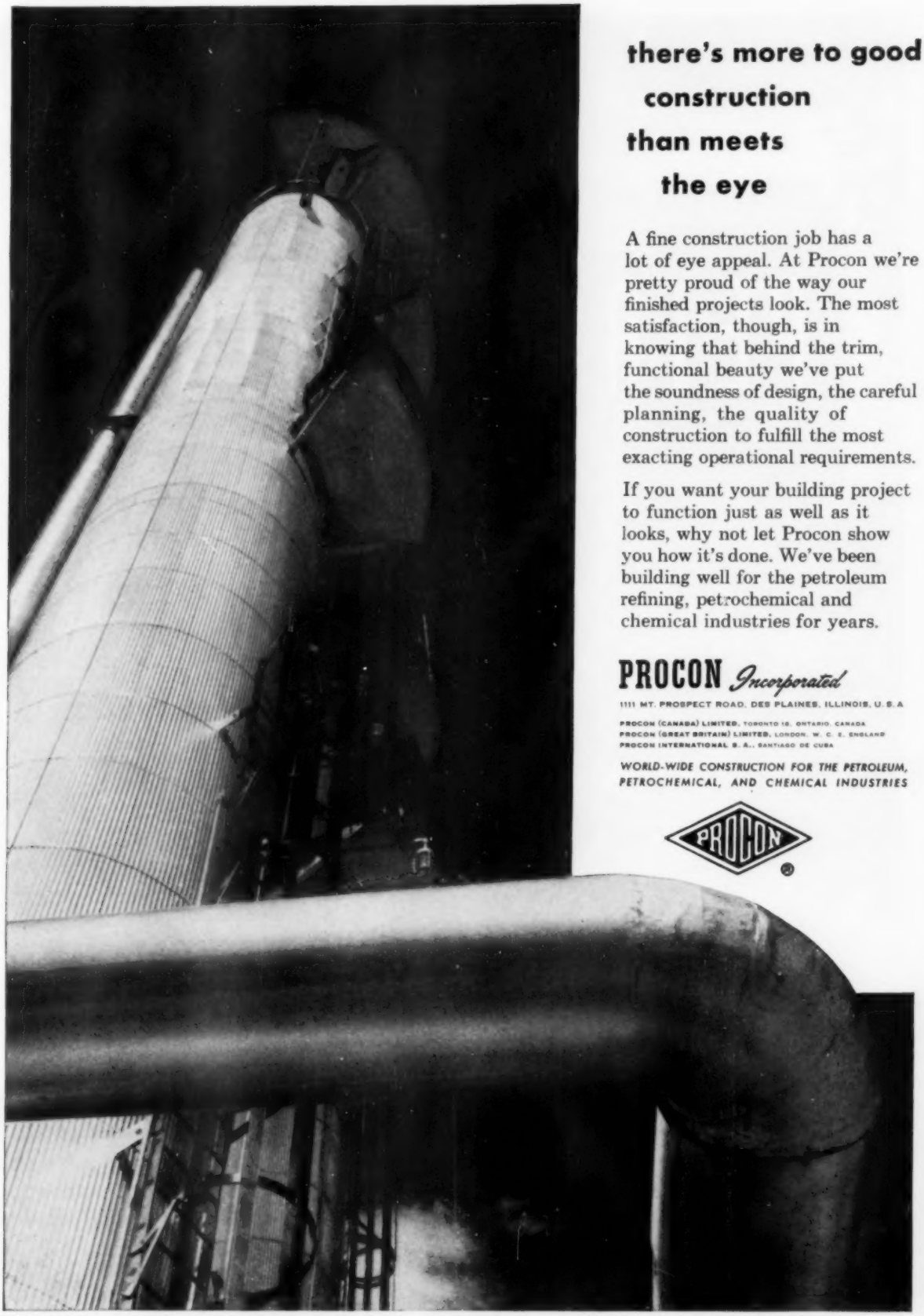
Now the Marpak system has been made still better by the use of today's miracle material—"Teflon." You probably know of the almost incredible toughness, resilience and non-adhesive properties of Teflon—properties that are unimpaired by the most powerful of solvents, acids, or alkalies, even at temperatures up to 500° F.! As a result of incorporating "Teflon" packing, Marsh Stainless Steel Needle Valves are now

Guaranteed for any pressure up to 10,000 psi at any temperature up to 500° F.

In other makes of valves permissable temperature *decreases* as pressure *increases*—but not with Marsh.

Teflon packing is one more addition to the list of features that are combined only in Marsh Stainless Steel Needle Throttling Valves. Note the list opposite...ask for bulletin.

MARSH INSTRUMENT CO. *Sales Affiliate of Jas. P. Marsh Corp.*, **Dept. L Skokie, Ill.**
Marsh Instrument and Valve Co. (Canada) Ltd., 8407 103rd St., Edmonton, Alberta
Houston Branch Plant: 1121 Rothwell St., Sect. 15, Houston, Texas



there's more to good construction than meets the eye

A fine construction job has a lot of eye appeal. At Procon we're pretty proud of the way our finished projects look. The most satisfaction, though, is in knowing that behind the trim, functional beauty we've put the soundness of design, the careful planning, the quality of construction to fulfill the most exacting operational requirements.

If you want your building project to function just as well as it looks, why not let Procon show you how it's done. We've been building well for the petroleum refining, petrochemical and chemical industries for years.

PROCON *Incorporated*

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PROCON (CANADA) LIMITED, TORONTO 18, ONTARIO, CANADA
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WORLD-WIDE CONSTRUCTION FOR THE PETROLEUM, PETROCHEMICAL, AND CHEMICAL INDUSTRIES

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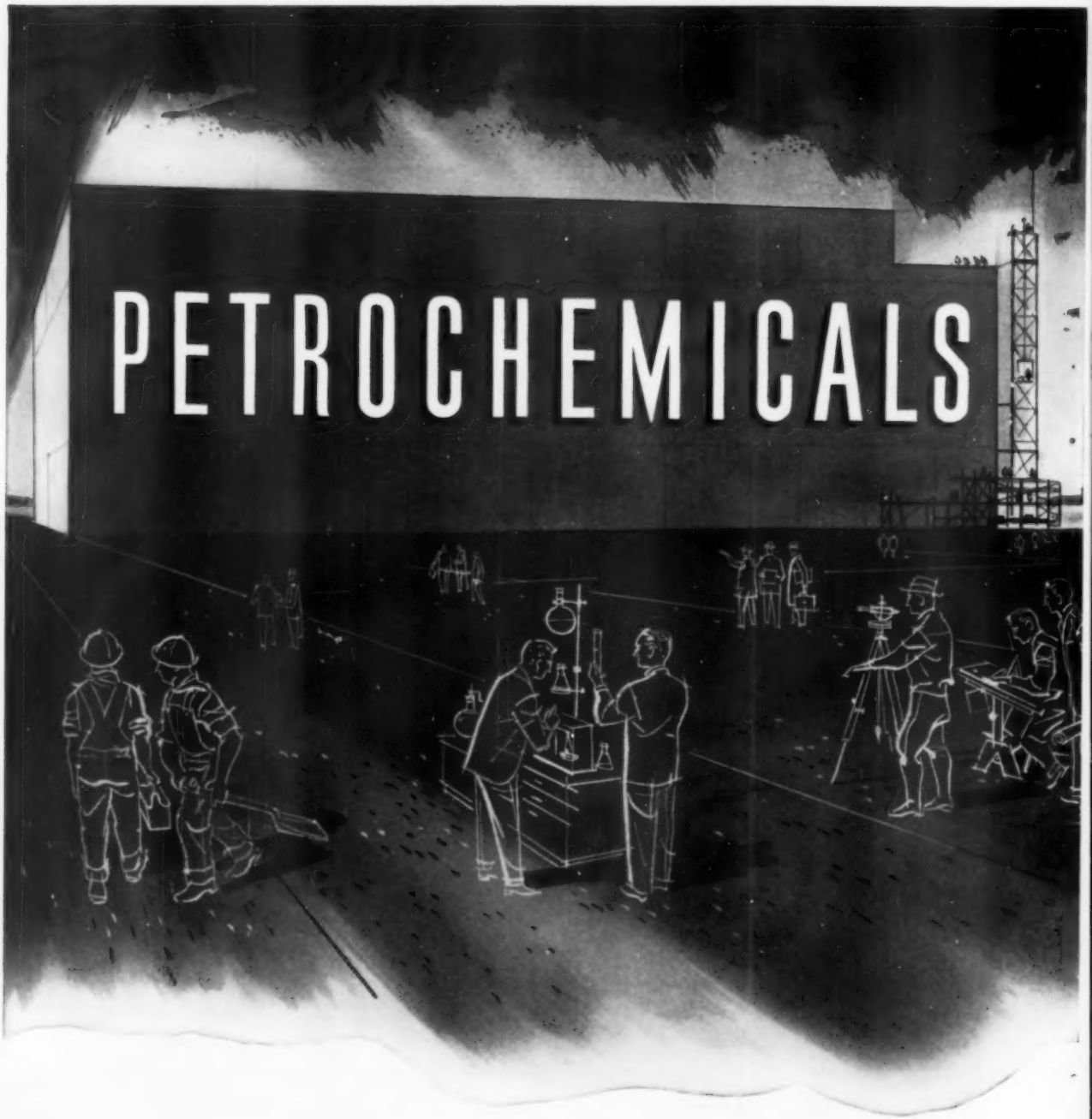
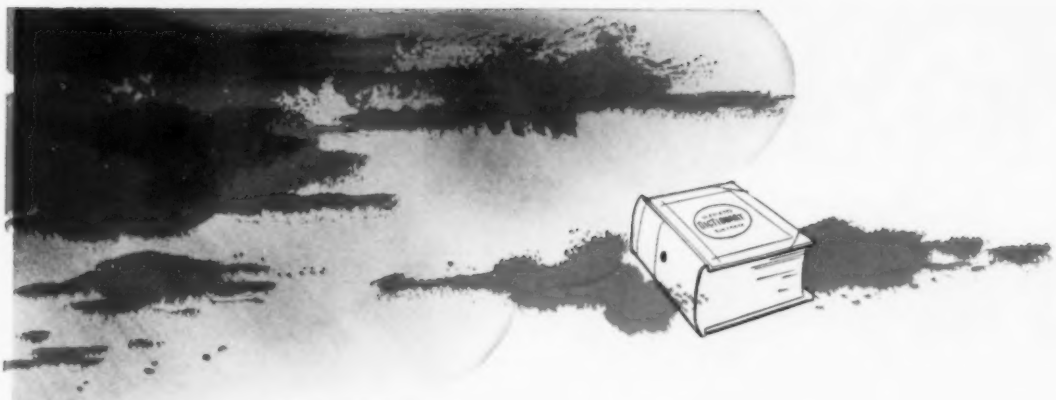


Research and engineering at UOP have been working for years developing and perfecting processes for producing petrochemicals. These are some of the UOP petrochemical processes now available to the refining industry . . . CATALYTIC CONDENSATION . . . OLEFIN EXTRACTION FOR BUTYLENE RECOVERY . . . CATALYTIC DEHYDROGENATION . . . HYDRAR® . . . UDEX® . . . TWO-STAGE UNIFINING* . . . AROSORB . . . ALKAR* . . . BUTAMER*



What it takes to build a new word

If your dictionary isn't the latest copy, chances are you won't find the word "Petrochemical" in it. It only got into the book a year or so ago. But a lot of time, thought and work went into its building. For many years scientists, designers and engineers in the petroleum industry have been developing the techniques for producing these important by-products that today make this word a most important one in our economy. For instance, here at UOP our research and engineering staff have been working for years, actively developing processes which yield valuable petrochemicals from petroleum raw materials and refinery by-products. Today UOP makes available to all refiners a number of petrochemical processes. These provide chemicals for the synthetics which have become part of our daily lives through their application to so many products now essential to our standard of living. Too, they help improve the economic efficiency of petroleum refining. UOP will be glad to supply, without obligation, individual recommendations for the practical application of its various petrochemical processes to any refining operation, anywhere in the free world.

UOP®

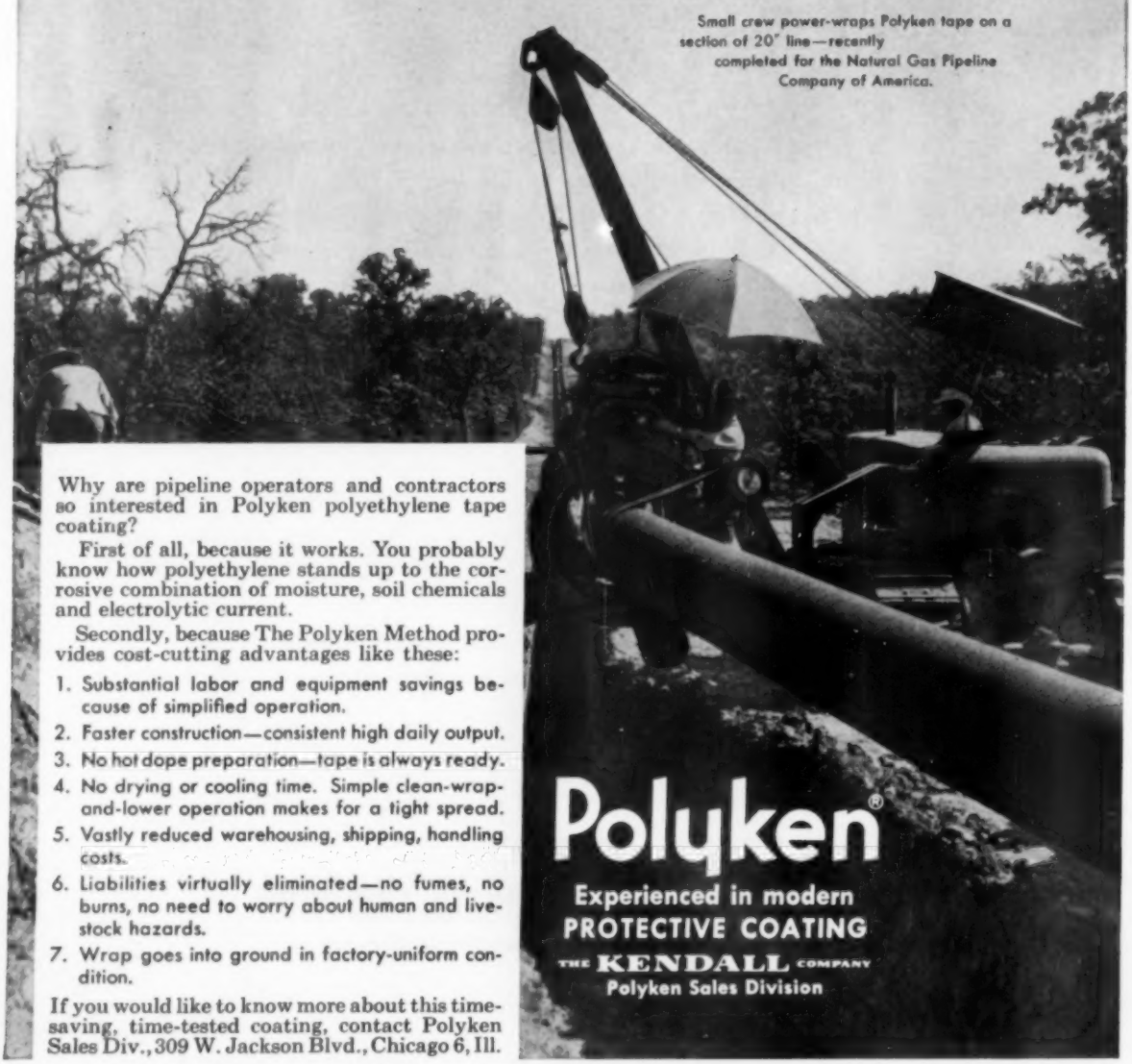
UNIVERSAL OIL PRODUCTS COMPANY

30 ALGONQUIN ROAD, DES PLAINES, ILLINOIS, U. S. A.

More Than Forty Years Of Leadership In Petroleum Refining Technology

Big-Inch pipeline wrapped the modern way

Polyken Tape saves time, labor and handling costs, yet resists corrosive attack as only polyethylene can



Small crew power-wraps Polyken tape on a section of 20" line—recently completed for the Natural Gas Pipeline Company of America.

Why are pipeline operators and contractors so interested in Polyken polyethylene tape coating?

First of all, because it works. You probably know how polyethylene stands up to the corrosive combination of moisture, soil chemicals and electrolytic current.

Secondly, because The Polyken Method provides cost-cutting advantages like these:

1. Substantial labor and equipment savings because of simplified operation.
2. Faster construction—consistent high daily output.
3. No hot dope preparation—tape is always ready.
4. No drying or cooling time. Simple clean-wrap-and-lower operation makes for a tight spread.
5. Vastly reduced warehousing, shipping, handling costs.
6. Liabilities virtually eliminated—no fumes, no burns, no need to worry about human and livestock hazards.
7. Wrap goes into ground in factory-uniform condition.

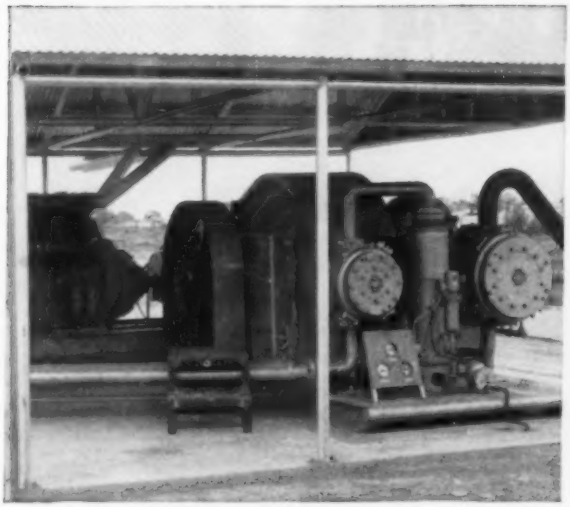
If you would like to know more about this time-saving, time-tested coating, contact Polyken Sales Div., 309 W. Jackson Blvd., Chicago 6, Ill.

Polyken®

Experienced in modern PROTECTIVE COATING

THE KENDALL COMPANY
Polyken Sales Division

Boost...



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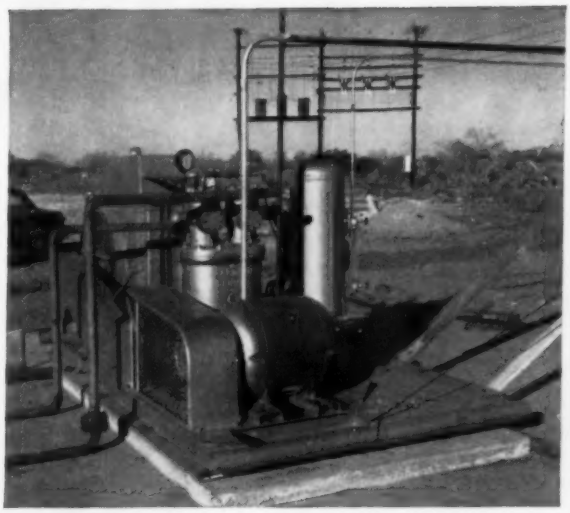

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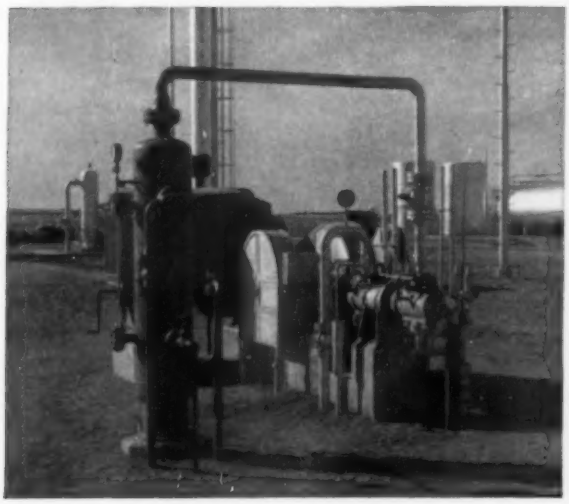
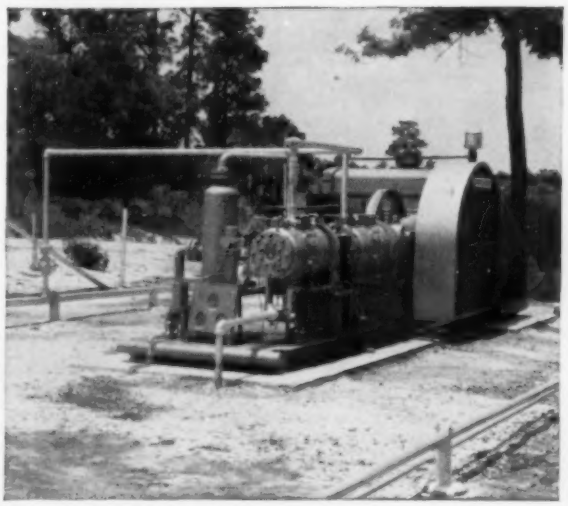


Lift...



Gardner-Denver gas compressors for every need and set of field conditions

- Vertical and horizontal gas compressor models
- Single- and two-stage gas compressor units
- A wide range of capacity and pressure ratings
- Sizes range from 5 to 360 horse power
- Tailored to individual field conditions
- Skid-mounted and completely assembled
- Low on oil consumption and maintenance
- Packaged units engineered and built at our Dallas oil field assembly plant

Write for full details

ENGINEERING FORESIGHT—PROVED ON THE JOB
IN GENERAL INDUSTRY, CONSTRUCTION, PETROLEUM AND MINING

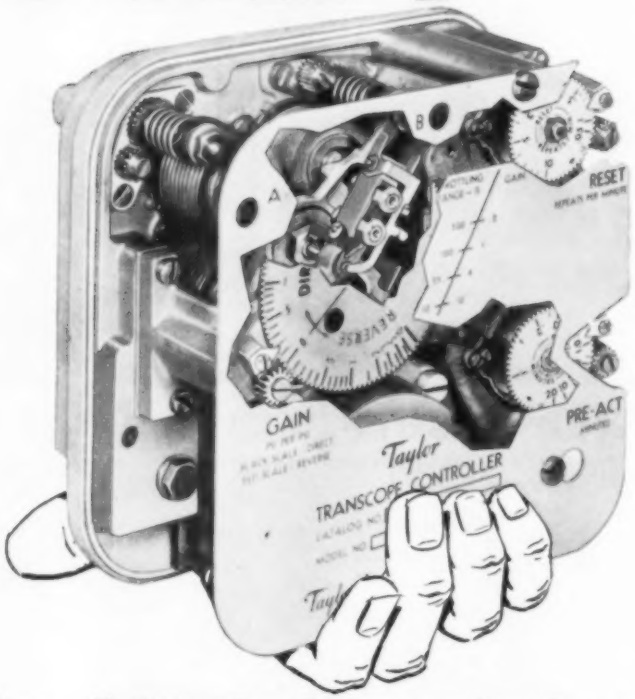
GARDNER-DENVER

Gardner-Denver Company, Quincy, Illinois
In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario
Gardner-Denver Export Division, 233 Broadway, New York, N.Y.
Oil field offices: Dallas, Houston, Tulsa, St. Louis, Los Angeles, New York, Pittsburgh, Denver, New Orleans, San Francisco, Kansas City, Winnipeg, Edmonton

NO DRIFT

Taylor

TRANSCOPE* Controller stands up to vibration and ambient temperatures



ROUGH handling in shipment, mechanical abuse in service, ambient temperatures . . . all are in a day's work for the TRANSCOPE Plug-in Controller. Its motion-balance design eliminates friction by the use of strip pivots, and it is resistant to shock because of its low mass. There's no loading when it's on control point. The large leakless booster relay positively will not stick.

1. EXCELLENT REPEATABILITY—Not only is the instrument extremely stable mechanically, but under widely *varying* ambient temperature conditions it still maintains its repeatability.

2. OUTSTANDING ADAPTABILITY—As well as providing all response adjustments for immediate requirements, the TRANSCOPE Controller can be quickly and simply adapted to changes in operating conditions or processing requirements. Result: minimum inventory of interchangeable spare parts.

3. HIGHLY ACCURATE RESPONSE SETTINGS—Precision manufacture of gain, reset and PRE-ACT* units permits pre-determined mathematical settings. Same settings in different instruments give same results—extremely valuable on preventative maintenance. Most accurate pneumatic settings available. Response to adjustments is exceptionally fast . . . a big "plus" on start-ups.

4. MAINTENANCE is simple because the motion-balance TRANSCOPE Controller is easy to understand . . . easy to get at. Most difficulties can be remedied without removal or dismantling, permitting speedy, visual alignment. Interchangeable components are keyed to their respective locations assuring correct assembly and alignment. Rugged bellows assembly, keyed in place, moves the dynamically balanced force plate.

IDEALLY SUITED for centralized control, scanning and logging systems. Because of its compactness, stability, responsiveness and simplicity, the TRANSCOPE Controller is a match for your toughest job. Ask your Taylor Field Engineer, or write for **Bulletin 98278.** Taylor Instrument Companies, Rochester, N.Y., and Toronto, Ontario.

*Trade-Mark

MADE FOR EACH OTHER

The combination of Taylor TRANSCOPE Recorder and Controller gives your operators the best tools possible for the most exacting jobs. *No other recorder, regardless of size, puts so many features in so little panel space.* Write now for **Form 98272.**

Taylor Instruments **MEAN ACCURACY FIRST**

DOW CORNING CORPORATION

Silicone News

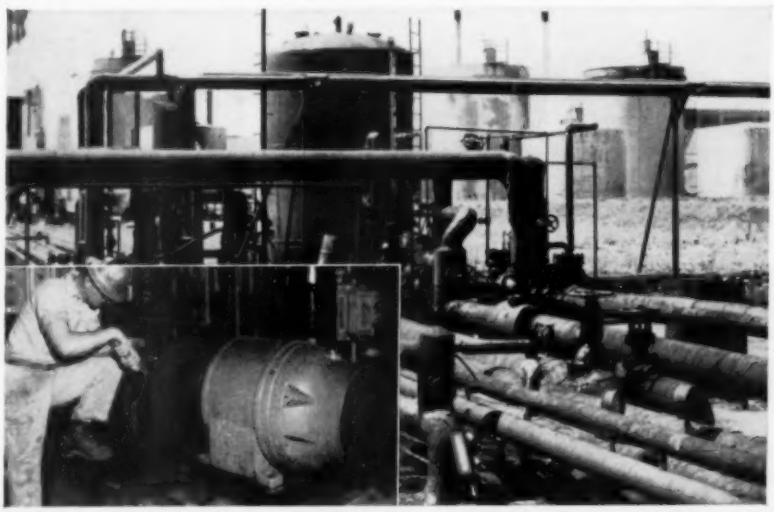
FOR PETROLEUM MEN — No. 4

END STICKING PROBLEMS

If you process a sticky product such as asphalt or synthetic rubber, the chances are you've had difficulty with it adhering to containers. Now, there's a way around the difficulty, through silicone coated paper or paperboard.

For example: a major producer of asphalt in the east switched from standard containers to silicone coated ones on the advice of its paperboard supplier. The new containers are conventional kraft folded drums, and they hold 100 pounds of asphalt. Their resistance to sticking is tremendous. The photo here illustrates how easily the container strips free . . . you can cut a "window" in it.

The company also learned that the silicone coating cut shipping weight over clay coated containers: as much as 100 pounds per 1000 drums. That means considerable saving in freight, when you consider that a carload of empty containers is some 35,000 boxes or drums. *No. 11*



GET MORE POWER FROM MOTORS

Increased flow through existing processing equipment can cause loads on motors to skyrocket. Yet these same motors, rewound with silicones, can give up to 50% more horsepower — and handle the load. Here's ten year proof:

Management of the Leonard Refineries in Alma, Michigan had a problem back in 1948. They had to step up the charge rate of crude to the refinery. But this meant that their pump motor would no longer be adequate. At the time, they were pumping seventy-six hundred barrels a day, and needed to increase this to eighty-three hundred barrels per day. A new, larger, higher-rated motor would be required to handle the increased load. This in turn would mean new pedestal, stand, fittings and connections to accommodate the large size replacement for the 30 hp, 3600 rpm unit.

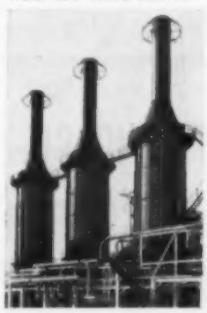
Rewinding with silicone insulation enabled them to uprate the motor 50%. Rewound ten years ago, it has been putting out more than 45 hp, 24 hours a day, ever since. Needless to add, Leonard men get their increased throughput — at a bare minimum of cost. *No. 10*

How To Eliminate Repainting Costs

Use a paint that lasts and lasts — protects surfaces so hot as to make the best conventional paints fail in short time.

The Cit-Con Oil Refinery, near Lake Charles, Louisiana, a joint enterprise of Cities Service and Continental Oil, is painted in silver and black, with the black on such hot surfaces as petrochem furnaces and boiler stacks.

However, conventional black paint lasted less than a year. So when annual shutdown time came for the steam boiler in 1952, maintenance engineers had its stacks painted with a single, brushed-on coat of a black finish by Allied Paint of Tulsa, based on Dow Corning Silicones. Later that year, all the other stacks in the plant were coated with the same finish.



Result: where formerly repainting was required every few months, the silicone finish lasts and lasts. Despite temperatures ranging from 350 to over 700 F, the silicone paint stays like new through as many as three annual shutdowns. *No. 12*

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Midland, Michigan
Please send me 10 11 12

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COMPANY _____
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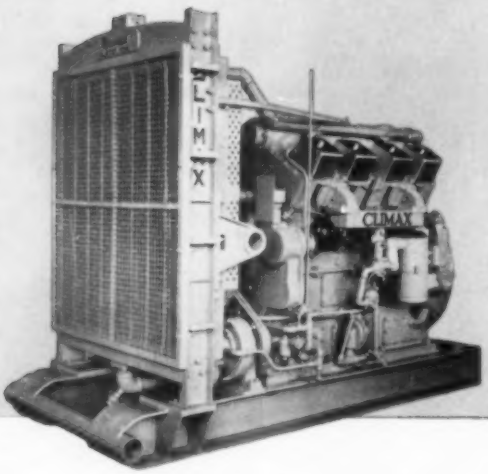
Canada: Dow Corning Silicones Ltd., Toronto; **Great Britain:** Midland Silicones, Ltd., London; **France:** St. Gobain, Paris

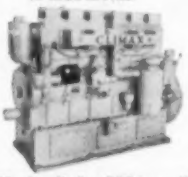
THE BIG FEATURE ABOUT CLIMAX ENGINES
IS THE **OWNER SATISFACTION**
THEY PROVIDE . . . .



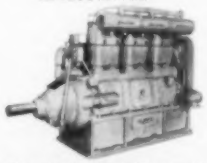
A Complete Line of Oil Field Engines up to 605 H.P.

V-125—12 cylinder, 605 max. H.P. at 1200 R. P. M.
V-122—12 cylinder, 520 max. H.P. at 1200 R. P. M.

V-85—8 cylinder, 390 max. H.P. at 1200 R. P. M.
V-80—8 cylinder, 340 max. H.P. at 1200 R. P. M.



K-75—6 cylinder, 302 max. H.P. at 1200 R. P. M.
K-67—6 cylinder, 265 max. H.P. at 1200 R. P. M.



R-165—6 cylinder, 192 max. H.P. at 1200 R. P. M.

. . . MIGHTY IMPORTANT TO CONSIDER WHEN YOU BUY AN ENGINE!

Here's why Climax Engines are so "owner satisfying"—

You get an engine that will give years of service on any job . . . whether powering drilling rigs, pumps, compressors or generators.

—an engine designed for easy starting . . . simplified operation . . . equal efficiency on natural gas, butane or gasoline by merely closing one set of valves and opening another . . . easy maintenance . . . readily accessible operating parts and accessories.

—an engine backed by prompt service throughout the oil country . . . friendly Climax Distributors offering a complete stock of parts, repair facilities and factory trained mechanics.

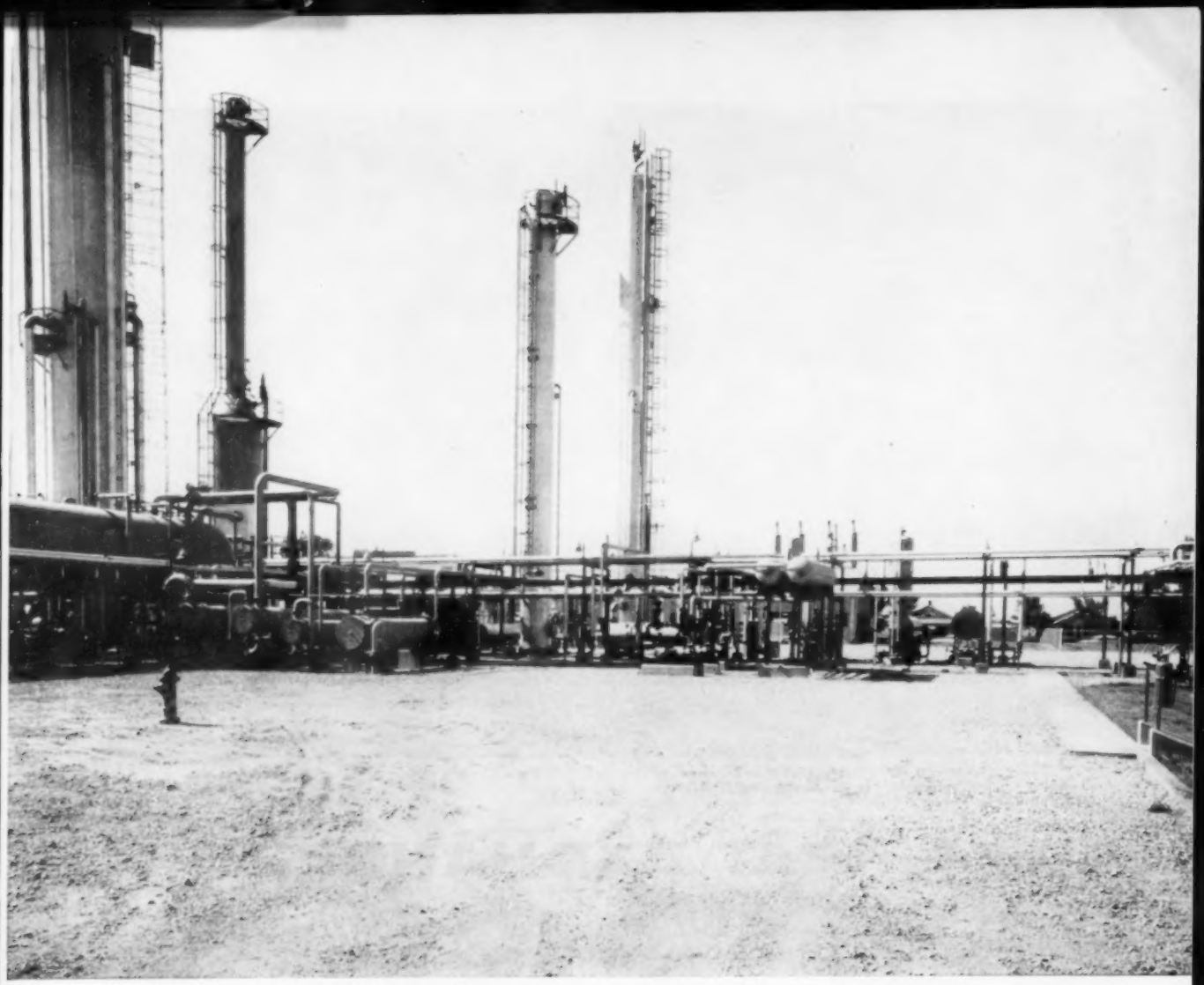
—these, plus many other Climax advantages, add up to owner satisfaction . . . the kind you get when you buy Climax Engines!

See, call or write your nearby Climax Distributor today!

CLIMAX ENGINE MANUFACTURING CO.
DIVISION OF WAUKESHA MOTOR COMPANY

•

FACTORY—CLINTON, IOWA



In this refinery of the Cities Service Oil Company, "Telvar", applied in May, kept area weed-free entire season. Throughout the oil industry, fire hazards and maintenance problems are greatly reduced by weed control with "Telvar".

Avoid fire hazards
Reduce maintenance costs—control weeds all season with one spraying

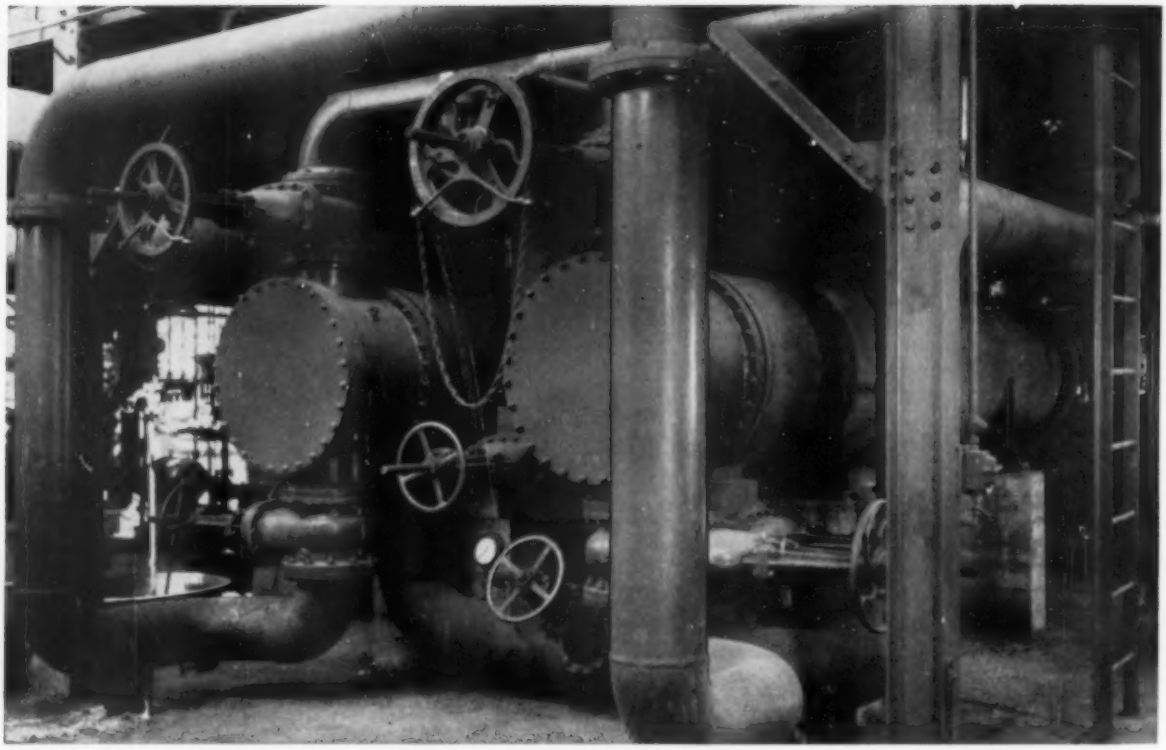
Now you can eliminate weeds and grasses that create fire hazards and make maintenance difficult. Just one application of Du Pont "Telvar" weed killer controls weeds for a season or longer. "Telvar" kills weeds through the roots . . . remains in the soil to provide residual action. Easy to handle, economical to use. Be sure to specify "Telvar"... for long-term weed control!

On all chemicals, follow label instructions and warnings carefully.

DU PONT
REG. U. S. PAT. OFF.
BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

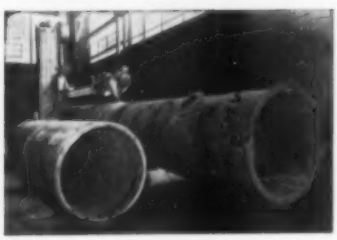
TELVAR®

MONURON AND DIURON WEED KILLERS



Two 31" x 19' 4" heat exchangers, with 1800 sq. ft. of heating surface each, installed in the plant of a large Eastern coke and coal chemicals company. In them, flushing liquor from the coke ovens heats a carbonate solution used in a special process for eliminating hydrogen sulphide from manufactured gas.

YUBA HEAT EXCHANGERS...



Engineered to Requirements

Yuba engineers scientifically rate and design heat exchangers to provide maximum heat transfer consistent with good operating practice. And to help rate these exchangers, Yuba has an electronic computer to make the *best* selection from many possibilities.

Yuba's superior engineering insures that initial cost of equipment is kept to a minimum. Proper design means low maintenance, with the end result a profitable operation. You will find Yuba's plants in the East and West thoroughly experienced in working with alloys as well as with time-tested carbon steel.

Contact the nearest office of our nationwide sales organization today and let us give you a quotation.

YUBA CONSOLIDATED INDUSTRIES, INC.

351 CALIFORNIA STREET, SAN FRANCISCO 4, CALIFORNIA

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YUBA HEAT TRANSFER DIVISION
Honesdale, Pennsylvania

YUBA MANUFACTURING DIVISION
Benicia, California

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San Francisco Sales Office:
520 Balfour Building

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530 Fifth Avenue

Sales Offices and Representatives in Principal Cities

Maybe you're paying for top quality "Commercial Grade" Roller Bearings...BUT ARE YOU GETTING THEM?

True, there's a wide difference in quality and cost between the low-range and high-range of any "commercial grade" bearing. But every Rollway Tru-Rol "commercial grade" bearing approximates as closely as possible maximum standards of construction consistent with the price.

Take the matter of separators, for example: In Rollway bearings, separators give maximum guidance to each roller. The result is greater total load capacity and longer life.

Equal spacing of rollers means uniform distribution of load. The result is the elimination of destructive "pulse" and vibration.

Cutaway view of Rollway Tru-Rol® segmented-retainer roller bearing . . . one of three distinct types of Tru-Rol bearings available.

Moreover, separators are of deep section, formed to the curve of the rollers, giving true axial alignment, smooth-surface contact and an even lubrication film on each roller

It's little things like these that mount up to big savings in service. Check the accompanying list, or ask a nearby Rollway Service Engineer to explain in detail the quality you should be getting in your "commercial grade" bearings. No cost. No obligation Just write us. Rollway Bearing Co., Inc., 586 Seymour St., Syracuse, N. Y., *manufacturers of a complete line of radial and thrust cylindrical roller bearings.*

ENGINEERING OFFICES: SYRACUSE • BOSTON • CHICAGO • DETROIT • TORONTO • PITTSBURGH • CLEVELAND • MILWAUKEE • SEATTLE • HOUSTON • PHILADELPHIA • LOS ANGELES • SAN FRANCISCO

Check This List AND BE SURE!

Retainer Operation

☐ Is the retainer roller-supported, to reduce sliding friction?

Retainer Construction

☐ Is the retainer strong enough to withstand shock loads and sudden reversals?

(A Rollway segmented-type steel retainer, such as that illustrated, is the strongest, most durable available in commercial grade bearings.)

Roller Spacing

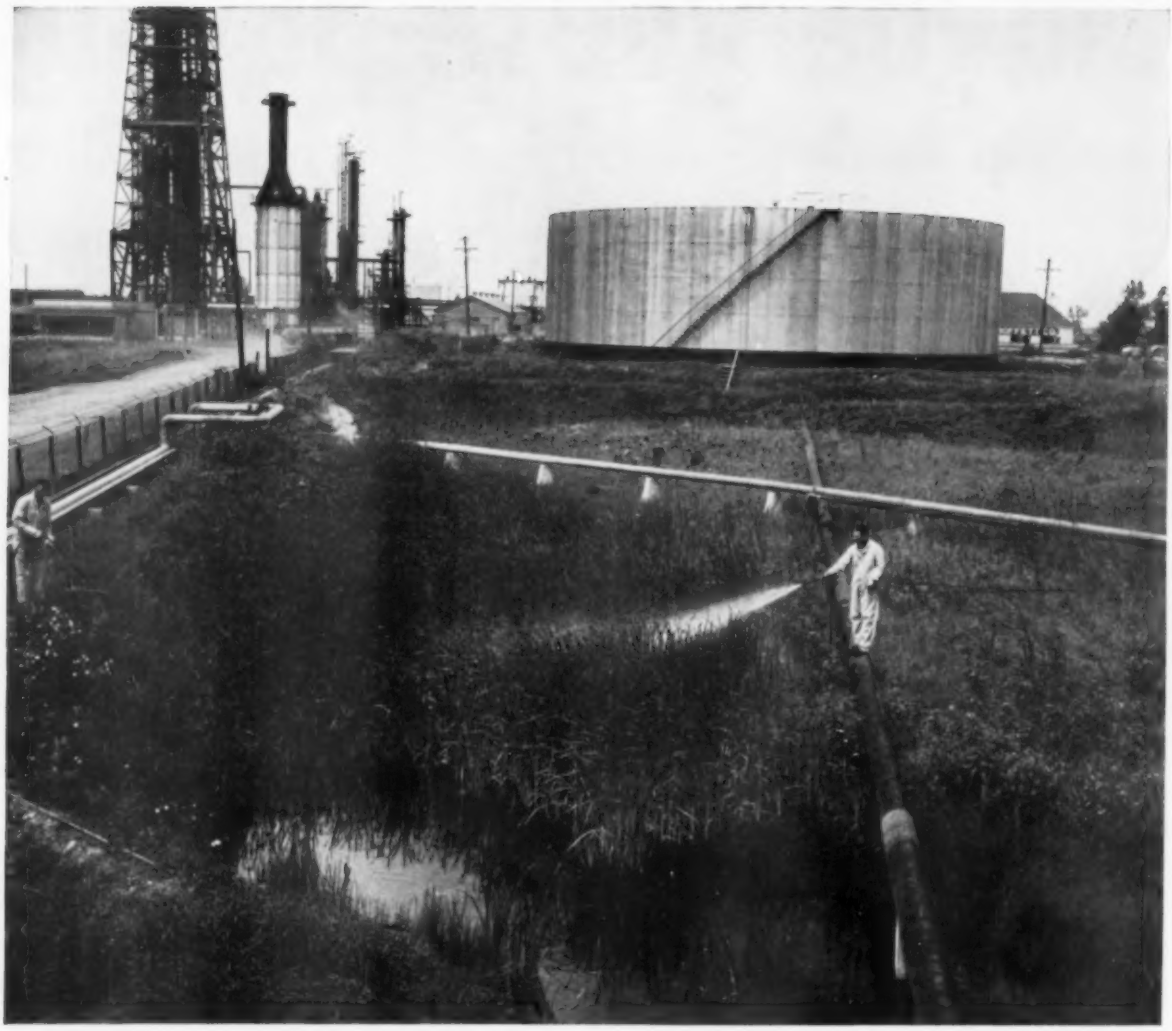
☐ Are all rollers equally separated, or do some rub against each other in opposed-motion friction?

☐ Are rollers distributed evenly to prevent "pulse" and vibration?

Roller Construction

☐ Are the rollers crowned for optimum load distribution?

For Top Quality in Every Detail Buy Tru-Rol and Be Sure!



Weeds are a hazard you can't afford!

Destroy them with Baron, Radapon and other Dow weed killers

Weeds are a nuisance. They clog drainage ditches, block access to valves and operating equipment, make your property unsightly. But worst of all, weeds create a dangerous fire hazard around tanks and pipelines. One match dropped thoughtlessly along an outside fence can send flames leaping through dry weeds toward storage tanks and valuable equipment. Result—fire losses running into thousands of dollars.

Think what a little foresight—and a Dow vegetation control program can do for you.

Baron®, Radapon® and other Dow products control weeds and unwanted grasses. They're money-saving and easy to apply. Your own men can do the job, or professional contractors can be called in to do the work. Dow will be pleased to send you, upon request, the name of a qualified distributor nearest you.

Write today for free literature on industrial vegetation control. THE DOW CHEMICAL COMPANY, Agr. Chemical Sales Dept., Midland, Mich.

YOU CAN DEPEND ON DOW

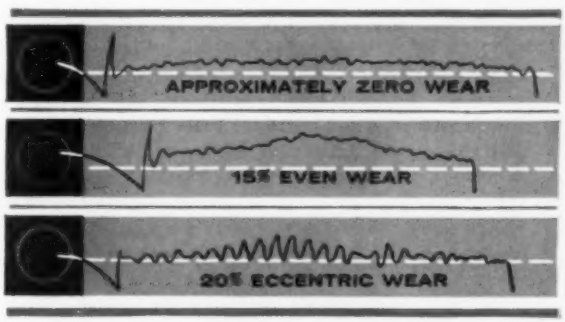
Tailored for Offshore Operations . . .
Tuboscope Company's used drillpipe inspection

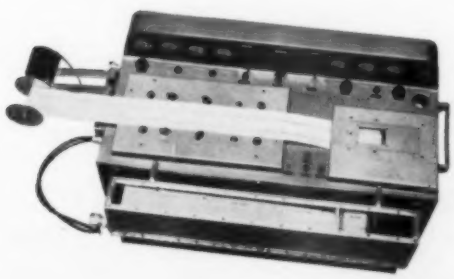
SONOSCOPE /SOLOG

Tuboscope's Isolog® measures and records wall thickness of drill pipe as it is being pulled from the hole. As the pipe is being pulled, a gamma ray beam is continually directed diametrically through it. Variations in pipe wall thickness cause corresponding variations in the amount of gamma rays passing through the pipe to a scintillation counter. These variations result in corresponding variations in the signal transmitted to the recorder, indicating relative wall thickness.

The standard Sonoscope® detects and records inside and outside surface discontinuities as the pipe is being pulled from the hole. When performing an Isolog-Sonoscope inspection, the operator, by scanning the logs being produced, quickly determines the effect of defects and wall thickness reductions on serviceability of the pipe.

- Measures wall thickness while coming out of the hole
- Detects fatigue cracks, corrosion, pits, cuts, etc.
- Detects internal structural conditions

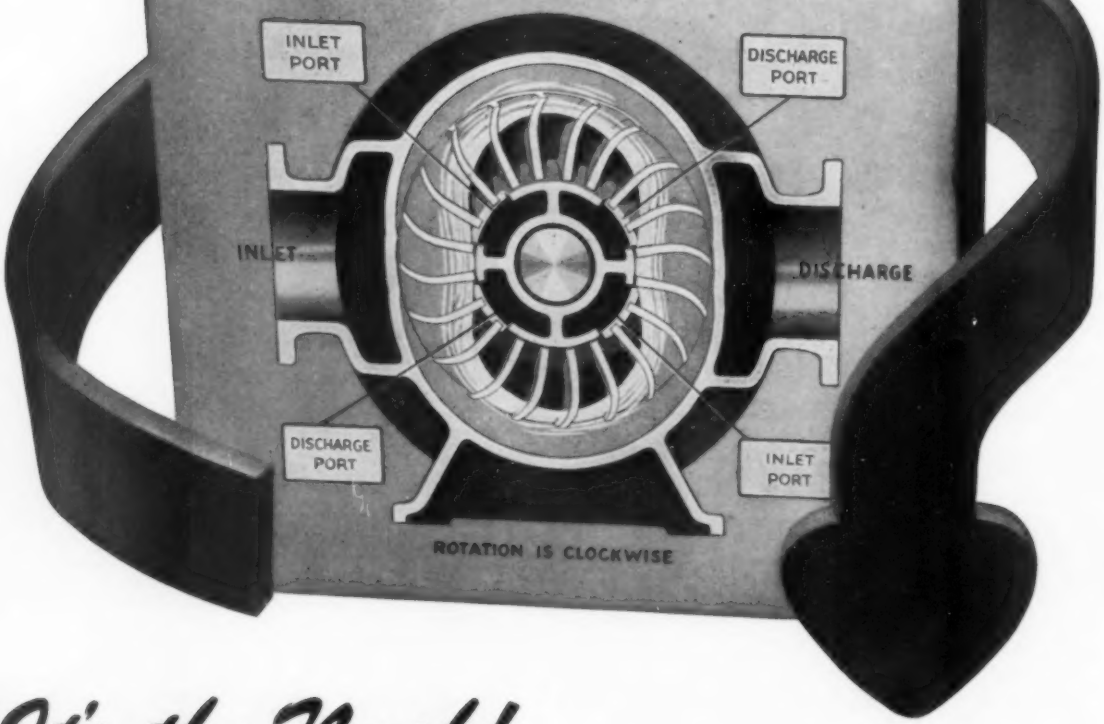




Tuboscope COMPANY

2919 HOLMES RD.
HOUSTON, TEXAS

This is Why the Nash is the Most Simple Compressor



It's the Nash!

There are no mechanical complications in a Nash Compressor. A single moving element, a round rotor, with shrouded blades, forming a series of buckets, revolves freely in an elliptical casing containing any low viscosity liquid. This liquid, carried with the rotor, follows the elliptical contour of the casing.

The moving liquid therefore recedes from the rotor buckets at the wide part of the ellipse, permitting the buckets to fill with gas from the stationary Inlet Ports. As the casing narrows, the liquid is forced back into the rotor buckets, compressing the gas, and delivering it through the fixed Outlet Ports.

Nash Compressors produce 75 lbs pressure in a single stage, with capacities to 6 million cu. ft. per day in a single structure. Since compression is secured by an entirely different principle, gas pumping problems difficult with ordinary pumps are often handled easily in a Nash.

Nash simplicity means low maintenance cost, with original pump performance constant over long periods Data on these pumps sent immediately on request

No internal wearing parts.

No valves, pistons, or vanes.

No internal lubrication.

Low maintenance cost.

Saves floor space.

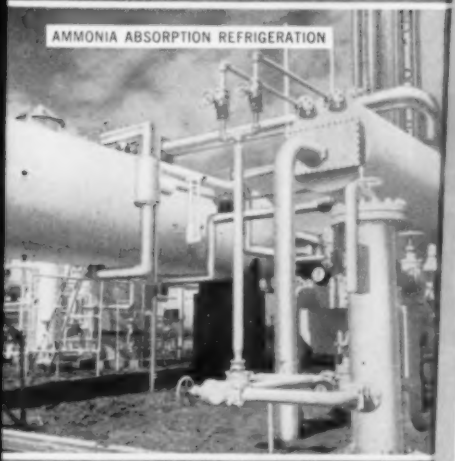
Desired delivery temperature automatically maintained.

Slugs of liquid entering pump will do no harm.

75 pounds in a single stage.

NASH ENGINEERING COMPANY

313 WILSON, SO. NORWALK, CONN.



BS&B RESEARCH SHOWS THE WAY

• To Better Equipment For Oilfield Production, Gas Processing... And Full Lease Automation!

Beginning with the manufacture of wooden tanks for gauging and storage back in 1893, BS&B for 64 years has served the equipment needs of oilfield production men wherever crude oil was being produced.

As changing times have called for better and more *specialized* equipment to do a more comprehensive field production job, BS&B has taken the lead in the development of new and better equipment to meet these requirements.

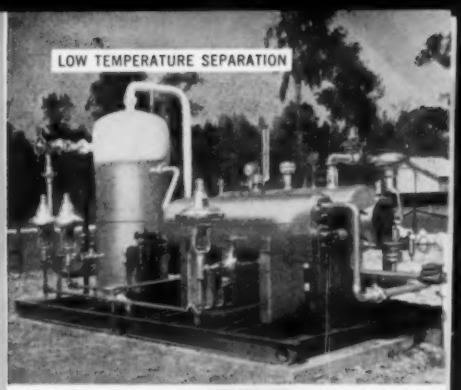
Two recent examples are the introduction of BS&B *"Phanto-Matic" Lease Systems* which provide full lease automation from the wellhead to the pipeline, and the BS&B *Ammonia Absorption Refrigeration System* which utilizes power from natural gas on the lease to produce refrigeration temperatures below 0° F. Both were developed at BS&B's modern research and development laboratory facilities, unique in the industry.

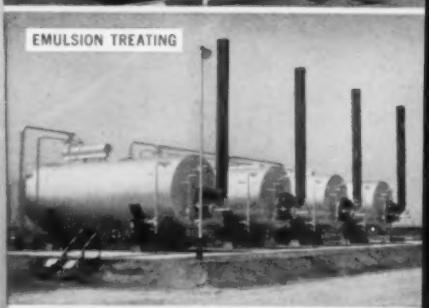
BS&B is dedicated to providing the industry with the finest oilfield production equipment, commensurate with the technology of the times.

BLACK, SIVALLS & BRYSON, INC.

OVER 60 YEARS — BS&B — ANOTHER EXAMPLE OF PRODUCT LEADERSHIP

Oilfield Equipment Division, Dept. 1-A4B
P. O. Box 1714 Oklahoma City, Okla.





FOXBORO
TYPE 12 A
TEMPERATURE TRANSMITTER
SER.
ADJUSTED RANGE
15 PSI =
3 PSI =
THE FOXBORO COMPANY
FOXBORO, MASS., U.S.A.
FOXBORO
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Type 12A pneumatic

Temperature Transmitter Improves Remote Control

• fast — sensitive — rugged!

There is no easier, simpler way to measure remote temperatures, over so wide a range, with such high sustained accuracy and speed, and at so low a cost!

The Type 12A Temperature Transmitter converts temperature measurement to a linear air output signal, which is transmitted to any standard 3-15 psi recorder or controller. Measuring spans of 50, 100, 200, 300, or 400 degrees F. are available, set as required within the over-all transmitter range of −100°F. (lower when necessary) to +1000°F. Fully compensated for ambient temperatures and pressure, this rugged, highly responsive instrument performs outstandingly under the most severe conditions. And it's insensitive to mechanical vibration.

The transmitter weighs only 7 pounds with its integral mounting bracket. It can be mounted anywhere . . . in any position . . . even directly on a bulb well! The gasketed, weatherproof housing permits installation in any hazardous, corrosive, or outdoor location. Transmission line is conventional air tubing — no troublesome conduit, no costly capillary to run.

Derivative action is furnished for optimum performance when process or transmission lags exist.

Write for Bulletin 13-17. It explains fully why the Foxboro Type 12A Temperature Transmitter gives better performance with lower installation and maintenance cost. **The Foxboro Company, 604 Neponset Ave., Foxboro, Mass., U.S.A.**

• • Pneumatic Temperature Transmission

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POWER UNITS · GENUINE PARTS
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THE LOVE COMPANY
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SOUTHERN COACH PARTS, Inc.
ALABAMA: Birmingham

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CANADA: Edmonton (Alb.), Estevan (Sask.)

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CANADA: Montreal (Quebec)

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WAUKESHA MOTOR COMPANY WAUKESHA, WISCONSIN ★ New York ★ Tulsa ★ Los Angeles

. . . that has never failed through 44 years of continuous operation

You must be sure of the financial strength and responsibility of the insurance company before you buy insurance.

The Texas Employers' Insurance Association has a perfect record of performance covering 44 years of providing sound, dependable protection for the employers of labor in Texas. The last statement of the Association shows a surplus of $8,358,100 for the protection of policyholders . . . the greatest margin in its history.

It's true . . . you get SECURITY, SERVICE and SAVINGS when you insure with Texas' largest writer of workmen's compensation insurance. Get full information NOW! Call, write or visit your nearest service office listed below, or write direct to . . .

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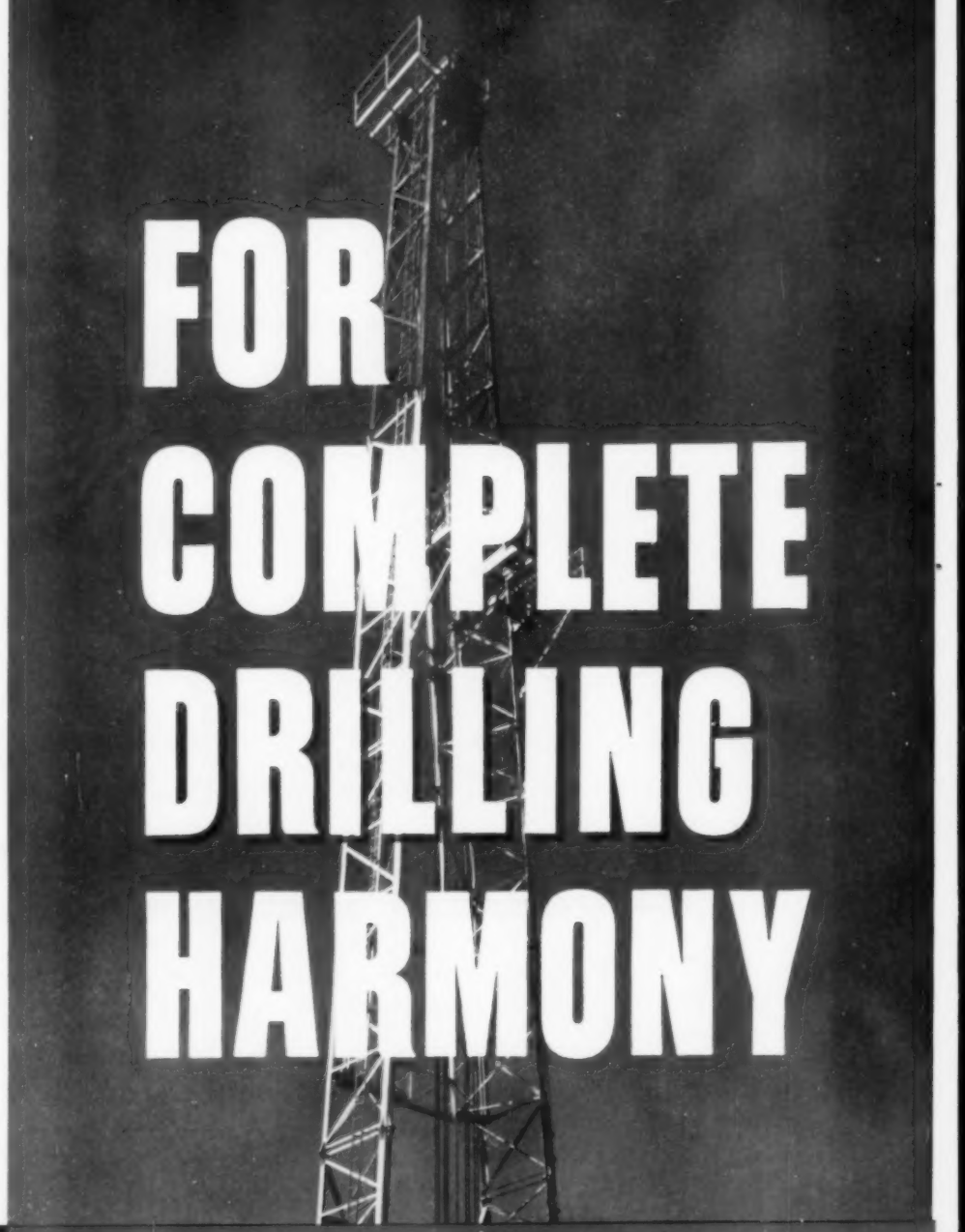

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WORLDWIDE

Where Faster Moves Mean More Pro

MINIMUM DOWNTIME ON RIG MOVES

Drawworks, engines, and compounding transmissions of the Continental-Emsco GC-350T and GC-500 rigs are mounted on a common skid . . . makes field moves quicker and easier. Only minimum disassembly is necessary for highway moves, too . . . no chain drives or oil lines to disconnect. Quicker installation on the substructure is possible with these exceptional rigs. This results in lower cost operation and more profit.

FINGER-TIP CONTROL

All operating controls are conveniently assembled in a console at the driller's position. Here the driller has full, unobstructed view of the rig floor and derrick operations . . . he operates the rig with a minimum of effort through push button speed selectors and air actuated clutches.

GREATER VERSATILITY

Two or three engines can be installed . . . depending upon *your* power requirements. Clutches are on the end of the shafts for simplified maintenance . . . flat or step setting easily accomplished . . . engine drives through torque converters, fluid couplings or Fawick Airflex clutches as preferred. Longer rig life is assured by pressure oil lubrication to chains and bearings, reducing maintenance.

. . Equipmen

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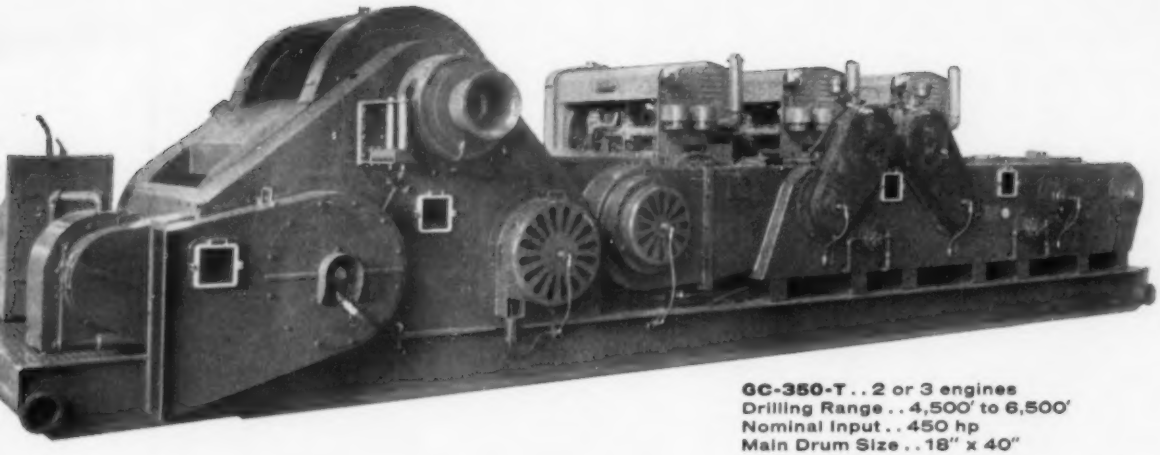

GC-350-T . . 2 or 3 engines
Drilling Range . . 4,500' to 6,500'
Nominal Input . . 450 hp
Main Drum Size . . 18" x 40"

Profit . . Choose These Unitized Rigs

GC-500 . . 2 or 3 engines
Drilling Range . . 5,500' to 8,500'
Nominal Input . . 600 hp
Main Drum Size . . 22" x 45"

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ATING RIGS ARE YOUR BEST BUY

You're safer with

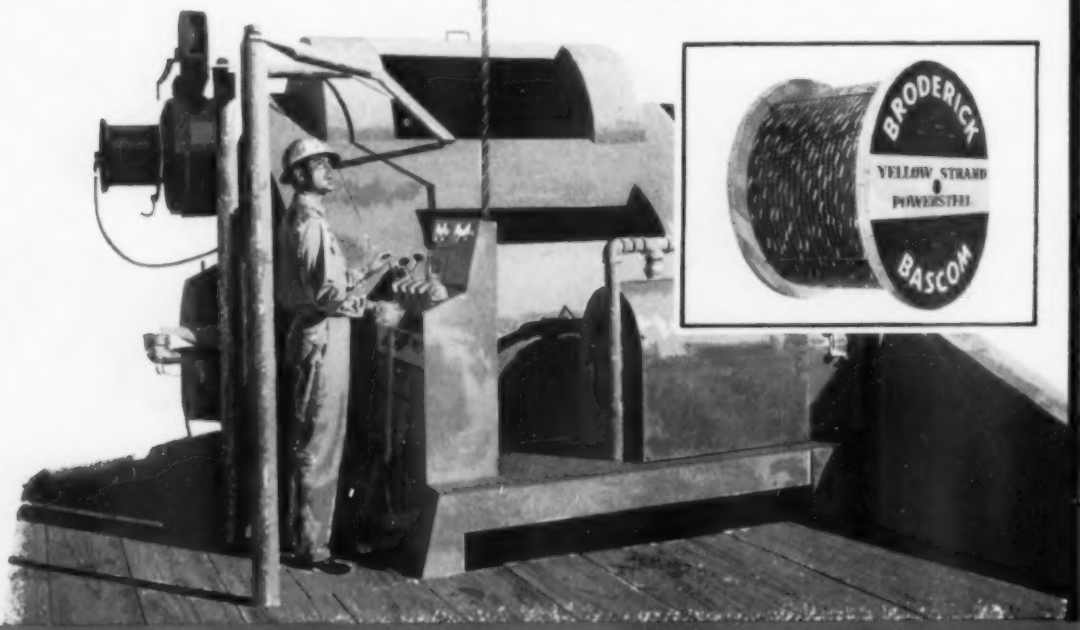
Yellow Strand®

"POWERSTEEL"
Wire Rope

When the derrick floor shakes and the drawworks groans as more power is applied to pull a stuck bit . . . it's great to know you're rigged-up with "POWERSTEEL." Such oil field emergencies are easily handled by this *Yellow Strand* wire rope with its *extra* reserve of *built-in* strength.

Always drill with "POWERSTEEL" for longer, safer wire-line service.

Yellow Strand
. . . complete stocks in all grades, sizes and construction are available through all Continental-Emsco stores.



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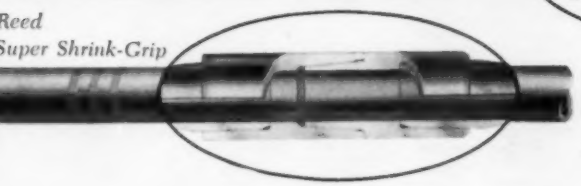
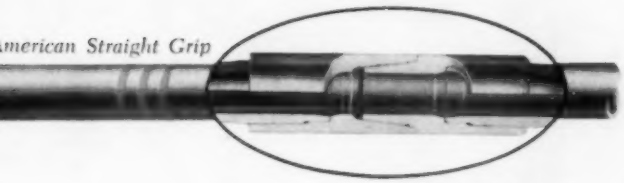
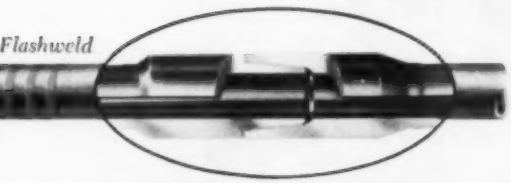
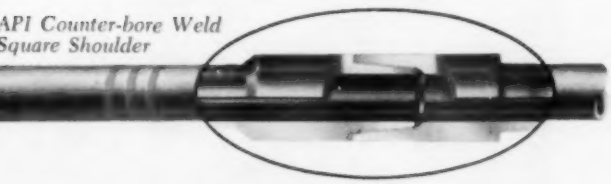


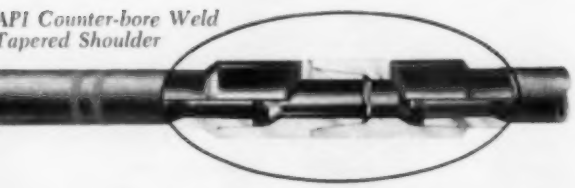


The Quality Names in Tool Joints Go with Quality-Built

YOUNGSTOWN DRILL PIPE







Welded joints are made by American, Hughes and Reed.

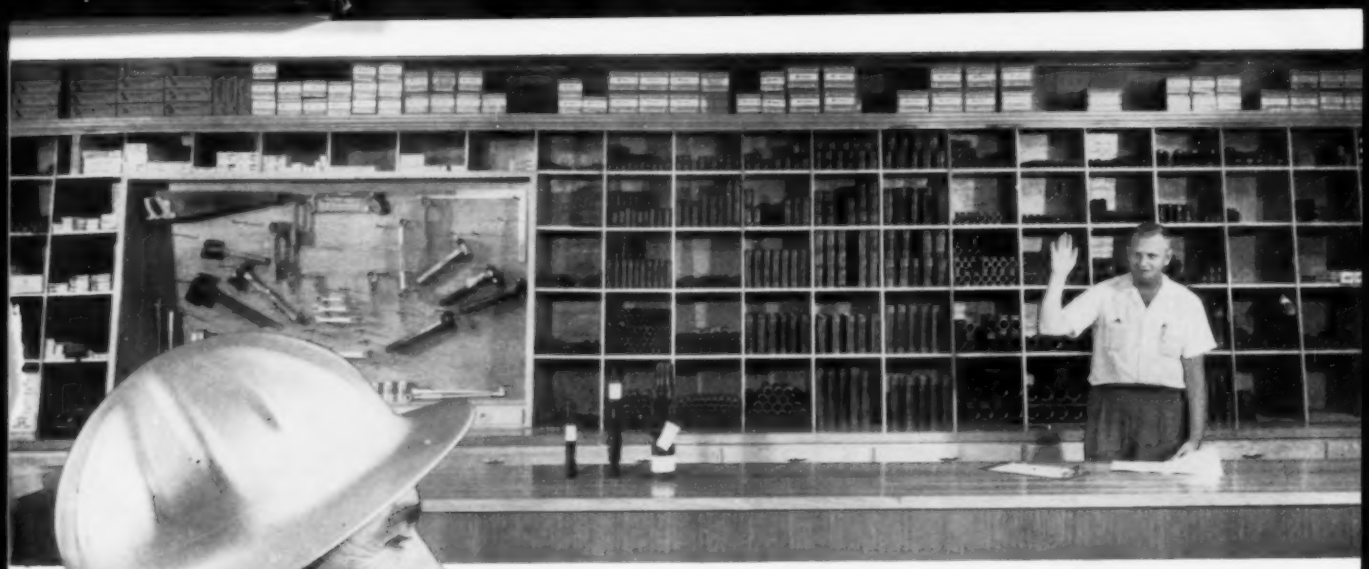
Extra quality is built into Youngstown Drill Pipe . . . the *highest quality* manufacturing to API specification in the industry. This means strings that just naturally last longer . . . give you more hole per dollar.

And quality-controlled Youngstown Drill Pipe fits all the quality names in tool joints . . . gives you a full range of grades . . . D, E and X-95 . . . for all drilling depths. These are reasons why so many contractors get a better buy with Youngstown Drill Pipe . . . from Continental-Emsco.

QUALITY YOUNGSTOWN SERVICE

e that Sings..

The familiar orange bands say Youngstown Drill Pipe and Top Quality



Hello Pat . .
What's New?

Here's a driller who's going places . . . a man who wants to be *in-the-know*. And what better place could he choose for up-to-the-minute information than at his nearby Continental-Emsco store . . . the *clearing house* for information about the latest in oil field tools, equipment and supplies.

The next time you need supplies . . . drop in and pick them up. See for yourself . . .*what's new.*

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Serving the Oil and Gas Industries ... Worldwide

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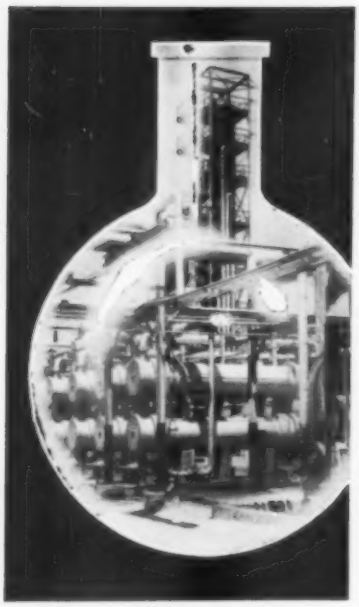
Oakite ECP . . .



Best way to clean a catalytic reformer

CASE HISTORIES document that the best way to clean a catalytic reformer is the Oakite ECP way . . which recommends *chemical circulation*. For one important refinery, the program slashed five days time on reformer towers alone, saved $3,300 on cost of former cleaning method.

An Oakite ENGINEERED CLEANING PROGRAM is developed specifically for your refinery, gives you detailed recommendations for cleaning everything from coolers to crackers. The Oakite Engineer sticks with the job till it's done to satisfaction. His experience and judgment, combined with the products and methods developed by the finest chemical cleaning facilities in existence, assure you *thorough* cleaning . . . *fast* cleaning . . . low-cost cleaning.

Send for more data. Oakite Products, Inc., 44C Rector St., N. Y. 6, N. Y.

OAKITE. ECP your economy key

In our 50th year

They Say—

Price cuts help nobody

"There is some limit beyond which production in this country should not be reduced.

"Let's assume this limit is reached and the entire reduction . . . is made up by imports. Let's assume further that an additional 300,000 bbl. a day of foreign imports would break the price of crude oil in this country by $1 a barrel.

"I see no advantage to our friends in Venezuela and the Near East, nor do I think consumers in the rest of the world would get much of a break.

"Venezuela and the Near East produce about 5,800,000 bbl. a day. To sell an additional 300,000 bbl. at $2 they would get $600,000 a day in gross revenues. If world prices followed U.S. prices, they would lose $5,800,000 a day. Obviously this would not be good business for them and it would be approaching national suicide for ourselves.

"It is not in the national interest to have unlimited imports which would break the price of oil, wreck the domestic industry, cut the profits of foreign producers, reduce the revenues and probably bust several foreign governments with the Commies on their doorstep, and show not one single benefit to the American citizen except perhaps cut the price of gasoline a few cents a gallon temporarily and, probably, if gasoline is still available, raise future prices substantially."

Francis A. Callery, Bank of the Southwest Building, Houston, in a reply to Will Clayton's published letter on imports.

More grammatical "data"

Dear Sir:

I just finished reading R. W. Miller's letter (congratulations to him) in "They Say" in the March 24 issue (p. 67). I was going to let the Editor's note pass without comment but I can't. Regardless of what Webster says, the word data is plural and requires a plural verb.

It is my understanding that usage determines what is included in Webster's dictionary. Because something is used many times over and finally rates a place in Webster, that doesn't necessarily make it correct. For example, "ain't" is also included in Webster, and it says "it is now used in dialect or illiterate speech." Although it is included, it still isn't correct English.

Let's use what is grammatically correct, not what has been established through misuse!

John M. Sweet
Billings, Mont.

Journal remakes a shoreline

Dear Sir:

Studying your 1957 insert map of crude-oil and product lines (OGJ, Mar. 11, 1957), I note that you have Long Island broken in two at the point where the Shinnecock Canal goes into Peconic Bay, but you do not have Cap Cod similarly divorced from the rest of Massachusetts by the much more important Cape Cod Canal which connects Buzzards Bay with Cape Cod. Be consistent.

Also, I note that you have Esso's product line running to Dracut. Say "Lowell." Nobody round here ever heard of Dracut.

Harold M. Fleming
Antrim, N. H.

Editor's note: Our artists are all Midwesterners, and it shows. However, that map is now obsolete. The latest wall map—one year newer—appeared as an insert in the March 10 issue.

Hiring the prof pays off

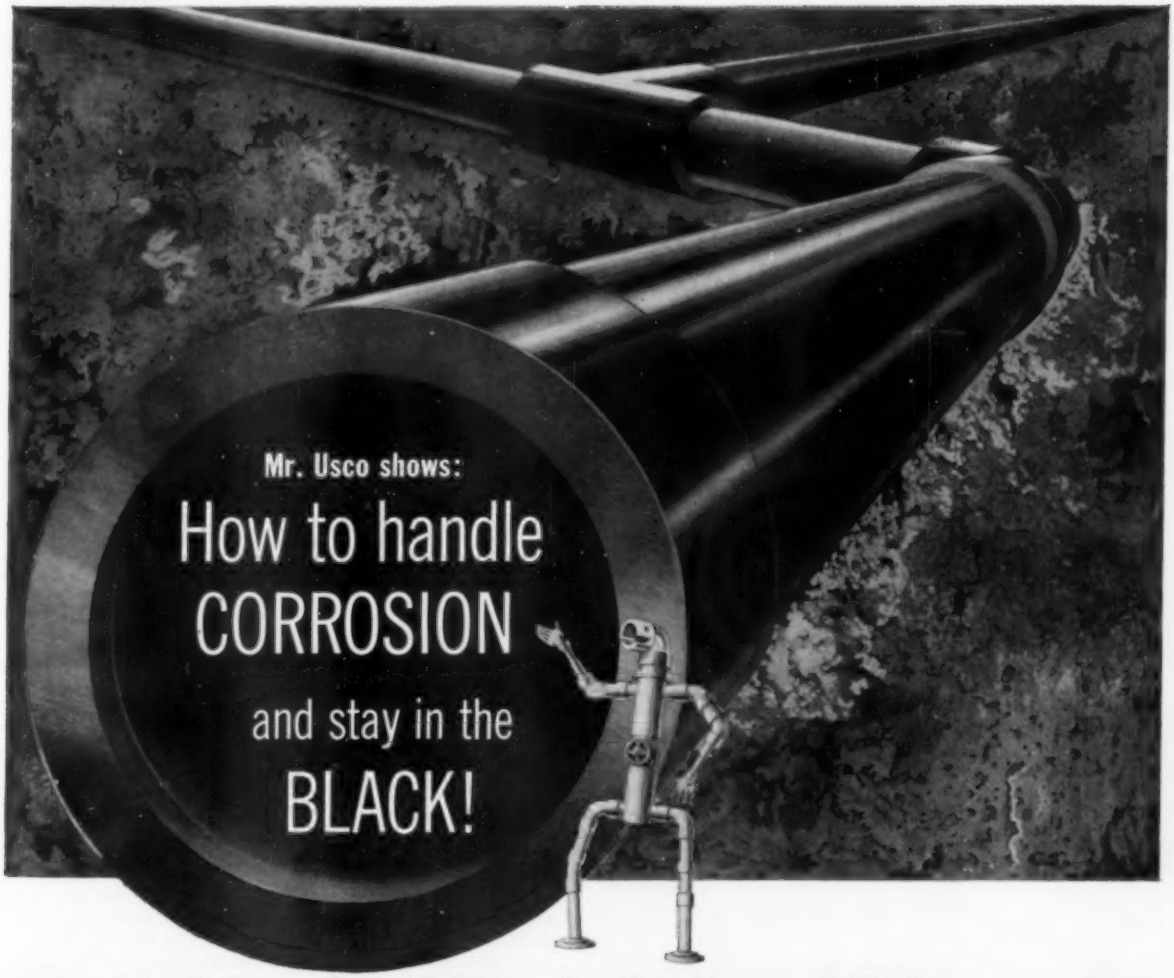
Dear Sir:

You can add my name to that of the professor from Baylor U. ("A Professor Laments . . . and An Editor Replies," OGJ, Mar. 17, p. 227). I'm with him 100%. I even go further. I believe that the oil companies should consider it an obligation to try to employ college faculty during the summer months when most of them are unemployed and in too many cases not receiving any income.

This would give the faculty newer ideas, thus freshening up their approach to their classes. The industry would gain both a salesman and an employment recruiter and the "poor" professor would have some income. This would aid his living standard, boost his morale, make him happier, and he'd be able to do a better job of teaching, turning out better prepared graduates for the industry. Industry, in turn, could shorten training periods, save more money there, and have the new employe sooner started on his career within the company.

One of the main reasons for my introduction of the Journal into my course in petroleum geology is that the students can get some idea of what

USCOFLOW PLASTIC PIPE



New black UscoFlow Utility plastic pipe and fittings provide economical corrosion resistance—inside and out

A blend of styrene-base resins and synthetic rubber to give good impact resistance and high, effective tensile strength...

A simple installation—rapidly solvent welded...

A friction-free finish that maintains high flow-rate and resists build-up of scale or other deposits...

An economical price to solve corrosion and high installation cost problems that would ordinarily chew into your profits...

All this is the *new* UscoFlow line of black plastic pipe and fittings, specially designed for economical and efficient handling of fluids. It has already proven its long service life, free of maintenance and downtime, and is recommended for such applications as

salt-water lines **fresh-water lines***
natural-gas lines **electrical conduit**

A full selection of UscoFlow pipe and fittings—plus expert engineering assistance—is available at any of the selected "U. S." Distributors, at "U. S." Branch Offices, or by contacting us at Rockefeller Center, New York 20, N. Y. In Canada, Dominion Rubber Co., Ltd.

**Uscolite is approved by the National Sanitation Foundation for use with potable water.*

Mechanical Goods Division

United States Rubber

See things you never saw before. Visit U. S. Rubber's new Exhibit Hall, Rockefeller Center, N. Y.

your key to access under pressure... ANY TIME!

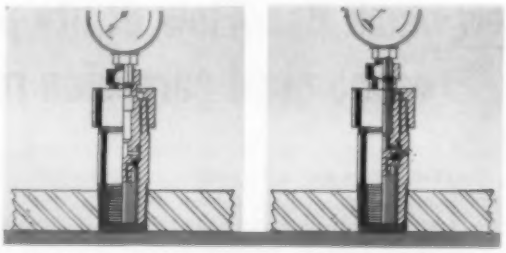
WHETHER IT'S oilfield production, refinery or pipeline application, the Cosasco Access Fitting is your key to entry against pressure—any time! With Cosasco Access Fittings you can seal off outlets but retain gaging or testing capacity... remove or replace valves or other externals... insert instruments, coupons, samplers, thermocouples and hydrogen probes without interfering with normal operations.

HOW IT WORKS. The Cosasco Access Fitting consists of three parts: a low-carbon stainless steel (Grade 303) *gage carrier plug*, a high-carbon steel *body* and a *safety ring*. In closed position (see illustrations at right), the plug primary seal presses against the tapered seat of the body, effectively blocking the flow of gas or fluid. In open position, the plug is backed off until it shoulders against the safety ring. This lifts the plug straight up from its seat and admits pressure—*but very little volume*—past the primary seal. Blocked by the O-ring secondary seal, the gas or fluid enters the plug through the by-pass holes for direct contact with gage or other external equipment.

ACCESS UNDER PRESSURE. By means of a special tool—the Cosasco High-Pressure Retriever—the gage carrier plug can be removed from the Access Fitting *under full operating pressure*. This enables the operator to gain access at will.

SAFETY. The Cosasco Access Fitting is the ultimate in safe devices for pressure readings. Only a minute volume of gas or fluid is ever admitted to the gage... yet accuracy is in no way impaired. Cosasco Access Fittings have a rated working pressure of 10,000 psi... are being successfully used at pressures in excess of this figure. Only 78 ft/lbs of torque are required to operate the gage carrier plug under 10,000 psi pressure, and the only tool needed is a standard box wrench.

FREE CATALOG. New 32-page catalog covers Cosasco's complete line of access fittings, including applications for oilfield production, wellheads, fracturing, drilling and corrosion surveys. Write for free copy today. Or send details and blueprints and let Cosasco Engineering Dept. solve your particular access-under-pressure problem.



Access Fitting closed. Primary seal in position against tapered seat of body. Plug is never in contact with body except at straight threads... is protected from pressure, fluid, distortion, wear at all times.

Access Fitting open. Gage carrier plug is shouldered against safety ring. Pressure is admitted past primary seal through by-pass holes into hollow plug interior. Secondary O-ring provides positive seal.

COSASCO®
DIVISION
PERFECT CIRCLE CORPORATION

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Export Office: 3631 Atlantic Blvd., Long Beach 7, California

Eliminate Bulky, Costly

Christmas Trees

with COSASCO®

UNITIZED WELLHEADS

employing advanced

Access Fitting principle

New Model 142 UNITIZED WELLHEAD

ASK THE MAN who's used one. Cosasco one-piece forged steel wellheads employing the advanced Access Fitting principle are more compact, economical and far safer than conventional Christmas tree installations.

ADVANTAGES OF UNITIZED WELLHEADS

VALVES ELIMINATED. Use of Cosasco Access Fittings eliminates bulky, expensive and hard-to-operate valves from flow lines. Wellhead dimensions are reduced to a minimum, while safe access to tubing and annulus is easier and faster than with conventional equipment.

COMPLETE BLOWOUT PROTECTION. With the Cosasco Unitized Wellhead, blowout prevention equipment need not be removed at any time during drilling and completion programs. Tubing is *positively blocked* during final completion. Standby time for flanging up wellhead connections is eliminated... and the entire hookup, including high-pressure flow lines and separators, can be tested for leaks *before* the well is put on production.

ADAPTABLE TO ANY WELL. Cosasco Wellheads are available for all casing programs, all A.P.I. series and pressure ratings to 30,000 psi. Thirty-two different methods of landing tubing are offered, including dual and triple string hangers. Solid mandrels or two-piece, annulus instrument study Kobe type, gas lift stripper, polish joint wrap-around, and injection arrangements can be furnished. All Cosasco Wellheads are available with female-thread-down, male-thread-down or slip-on-and-weld connections to casing.

FREE CATALOG. Write today for new 32-page illustrated Catalog covering Cosasco's complete line of Access Fittings and Unitized Wellheads.

NEW COSASCO WELLHEAD SERVICE TESTED FOR 30,000 psi WORKING PRESSURE!

Now COSASCO INTRODUCES the most compact, highest-pressure wellhead ever built—the Model 142 Unitized Wellhead. Through use of the advanced Cosasco Access Fitting principle, the Model 142 lands *four* strings of casing plus the production tubing...yet is only *55"* high over-all. It is actually service tested for *30,000* psi working pressure.

STEP-BY-STEP SAFETY CHECK. As each string is landed in the Cosasco Wellhead, the operator can test all fittings for leaks before proceeding with the next operation. Back-pressuring of intermediate casing strings to protect production casing and tubing from high-pressure collapse can then be done with complete safety.

ONE PIECE FORGED STEEL UNIT. Body of the Model 142 is hammer-forged from one billet of alloy steel. All stainless-steel construction (Gr. 303) is optional at moderate additional cost for off-shore submerged installation.

WELLHEAD ENGINEERING SERVICE

Discuss your wellhead problems with your Cosasco Field Man ...or write to Cosasco. We will furnish drawings, specifications and quotations—at no cost to you.

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PERFECT CIRCLE CORPORATION

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Export Office: 3631 Atlantic Blvd., Long Beach 7, California

is going on in the industry. I can't tell them because I haven't worked for an oil company since 1946. Methods then in use are now out-of-date and no longer used even by the smaller companies . . .

William R. Higgs
Department of Petroleum and Geological Engineering
Louisiana Polytechnic Institute
Ruston, La.

Case for Canadian exports

"Proven probable and possible reserves, as published by the Canadian Petroleum Association in this report, are sufficiently great that there is a need for immediate export of oil and gas to economic markets other than local ones in order to assure the continuing development of these reserves. . .

"In western Canada to the end of 1957 there were 12,250 oil wells drilled developing approximately 3.8 billion barrels of oil or an approximate total of 310,000 bbl. for each oil well. This is in comparison with around 130,000 bbl. for each oil well in the United States in the period 1925 to 1955.

"Thus from the standpoint of both total wells and oil wells drilled, the discovery rate in western Canada for its short history has been better than in the considerably longer period in the United States.

"Thus there is a considerable margin of safety in making the assumption that the discovery rate in Canada for many years to come will be at least the equivalent of what it has been in the United States over a long period."

Canadian Petroleum Association, in a brief submitted to the Borden Commission.

DESCO LUBRICANTS

STAY

in your plug valves – make plug valves stay on the job!

Plug valve lubrication is our business — *our only business!* DESCO Plug Valve Lubricants are synthetics made from chemical compounds specifically developed for each type of service. They are ALL lubricant and contain no inert material. That's why Desco Lubricants STAY in your valves and do not harden or coke-up.

HELPFUL COLOR CODE

The four Standard Lubricants are Color Coded to prevent errors and speed operation. Gun grip, valve tab, carton labels, and the lubricant itself are a matching color to identify the service.

4 STANDARD AND 3 SPECIAL DESCO LUBRICANTS HANDLE ALL SERVICES

The DESCO user has the advantage of never having to stock many lubricants – this not only reduces inventory but it also reduces the possibility of using the wrong lubricant. Most plants require only one or two types.

PACKED IN CONVENIENT STICKS OR BULK

DESCO Lubricants are available in 6 sizes of sticks, including a gun size stick. For volume users DESCO Lubricants are packed in 5-quart, 40-pound and 100-pound drums.

DELTA-DESCO

WRITE FOR CATALOG
The Only Complete Plug Valve Lubrication Company

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Color Coded Lubricants • Hand Guns
Fittings • Air-Motor Volume Guns
Automatic Lubricators • Electronics

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Box 1403 Shreveport, Louisiana
Branch Offices in All Principal Cities

"New oil" hunts for a market

"It appears that certain inequities exist both locally and between the oil producing states.

"Selective buying is hurting in many localities, where new production is having a very hard time finding a market in opposition to old established wellhead outlets. It is extremely difficult, however, to determine the relative rights of new and old producers in areas where the latter have been supplying oil on contract for many years.

"It is also equally difficult to know how far to 'move over' to allow new production a place in the picture when oil already is available. This development has been discouraging to prospective operators who fear for marketing of additional reserves, and the result has been reduced drilling operations in many regions.

"Regulation of crude-oil production varies sharply from state to state, and this fact has resulted in the tendency of a few states to hold the line much better than others in the face of an oil surplus.

"Conversely, some of the new oil producing states have been finding it difficult to get a market for oil as it comes into the over-all picture. Just how far the older producing states will go toward recognizing suggested quotas of the newer producing states remains somewhat of a question mark.

"At the present time the whole picture shapes up as one where most of the various states are seeking to hold whatever advantage they now have."

Brad Mills, executive vice president, American Association of Oilwell Drilling Contractors, in a speech to a University of Oklahoma short course.

ALL AROUND PROTECTION FOR PIPELINES IN CASINGS

WmSON M-2 PLASTIC

THINSULATOR®

For Gathering and Distribution Pipelines

WITH FOUR POINTS OF ADJUSTMENT . . . THINSULATOR FITS BARE OR COATED PIPE (4" & smaller have two joints)

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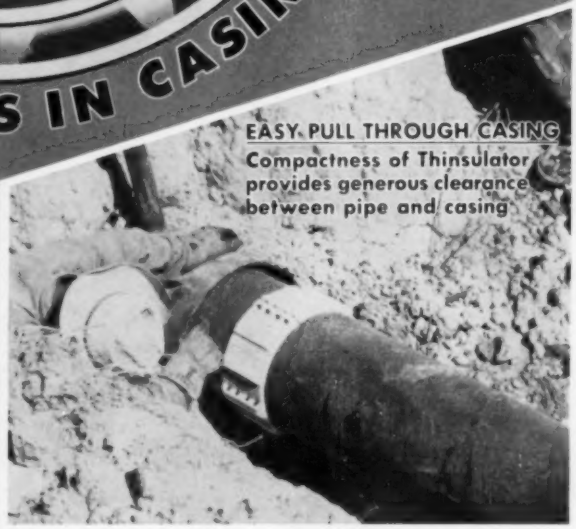

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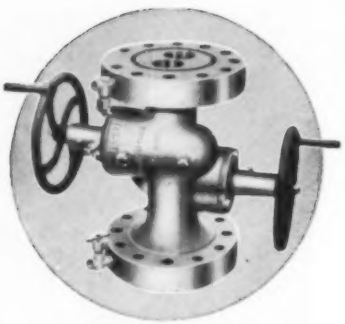

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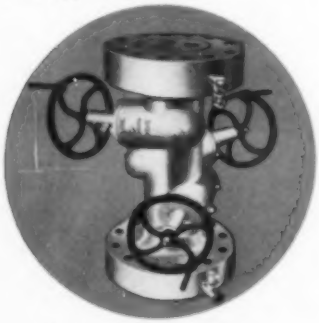

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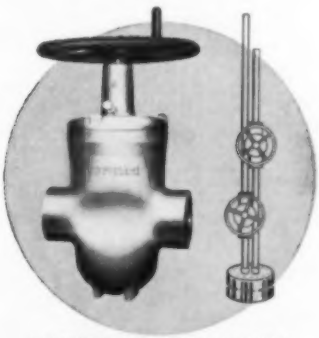

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CALENDAR

APRIL

23-25 Second International Williston Basin Symposium, sponsored by Saskatchewan Geological Society and North Dakota Geological Society, Regina.

27-30 American Association of Petroleum Geologists, Rocky Mountain section, Casper, Wyo.

28-29 University of Oklahoma, third annual conference on automatic control in the petroleum and chemical industries, Oklahoma Memorial Union Building, Norman, Okla.

28-29 Independent Petroleum Association of America, mid-year meeting, Sherman Hotel, Chicago.

28-30 Southern Gas Association, annual convention, Dallas.

29-May 1 Petroleum Industry Electrical Association, Petroleum Electric Supply Association, annual joint meeting, Adolphus Hotel, Dallas.

MAY

5-6 Society of Petroleum Engineers of AIME, North Texas section, secondary-recovery symposium, Wichita Falls, Tex.

5-7 Purdue University, thirteenth annual industrial waste conference, Purdue Memorial Union Building, Lafayette, Ind.

5-9 American Gas Association, distribution, production, and transmission conference, Roosevelt and Commodore Hotels, New York.

6-7 Pacific Coast Gas Association, gas supply and transmission conference, Town and Country Hotel, San Diego, Calif.

7-9 American Petroleum Institute, Division of Production, eastern district meeting, Deshler-Hilton Hotel, Columbus, Ohio.

8-9 Texas Petroleum Research Committee, eleventh oil recovery conference, symposium on "A Century of Texas Oil, 1875-1975," University of Texas, Austin.

11-14 Texas Independent Producers and Royalty Owners Association, annual membership meeting, San Antonio, Tex.

12-14 Chemical Institute of Canada, National Research Council, eighth Canadian high polymer forum, Macdonald College, St. Anne de Bellevue, Quebec.

12-14 Instrument Society of America, symposium of analysis instrumentation division, Shamrock Hilton Hotel, Houston.

12-15 American Petroleum Institute, Division of Refining, midyear meeting, Statler Hotel, Los Angeles.

12-15 American Society of Mechanical Engineers, oil and gas power division conference, Bellevue-Stratford Hotel, Philadelphia.

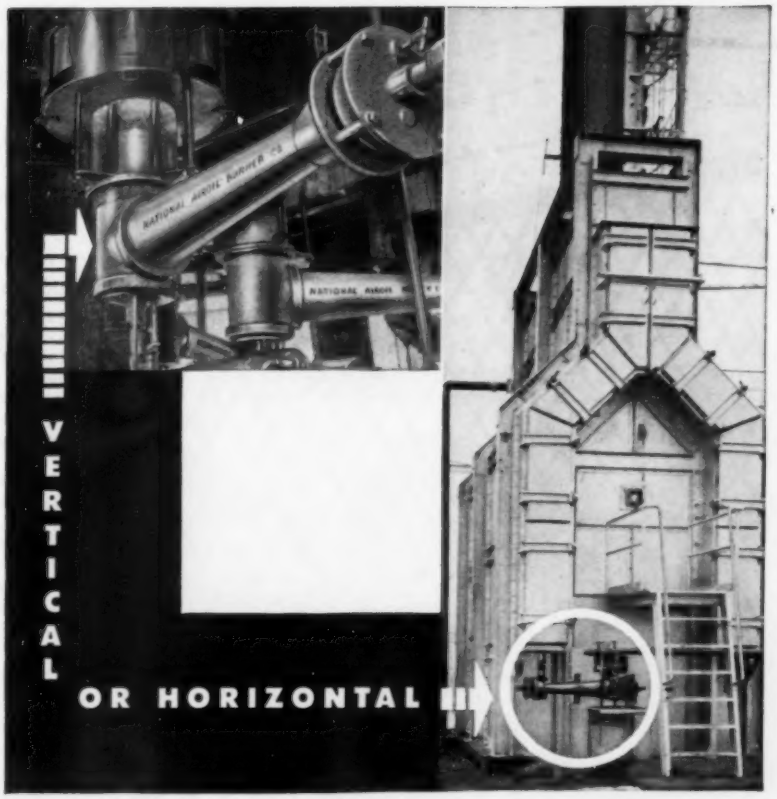
20-22 Pennsylvania Gas Association, annual meeting, Pocono Manor Inn, Pocono Manor, Pa.

21-22 Western Petroleum Refiners Association, Southwest regional technical-industrial relations meeting, Hotel Paso del Norte, El Paso, Tex.

21-23 Rocky Mountain Oil and Gas Association, thirteenth annual convention, Cosmopolitan Hotel, Denver.

21-23 American Petroleum Institute, Division of Marketing, midyear meeting, Roosevelt Hotel, New Orleans.

22-23 American Petroleum Institute, Division of Production, Pacific Coast



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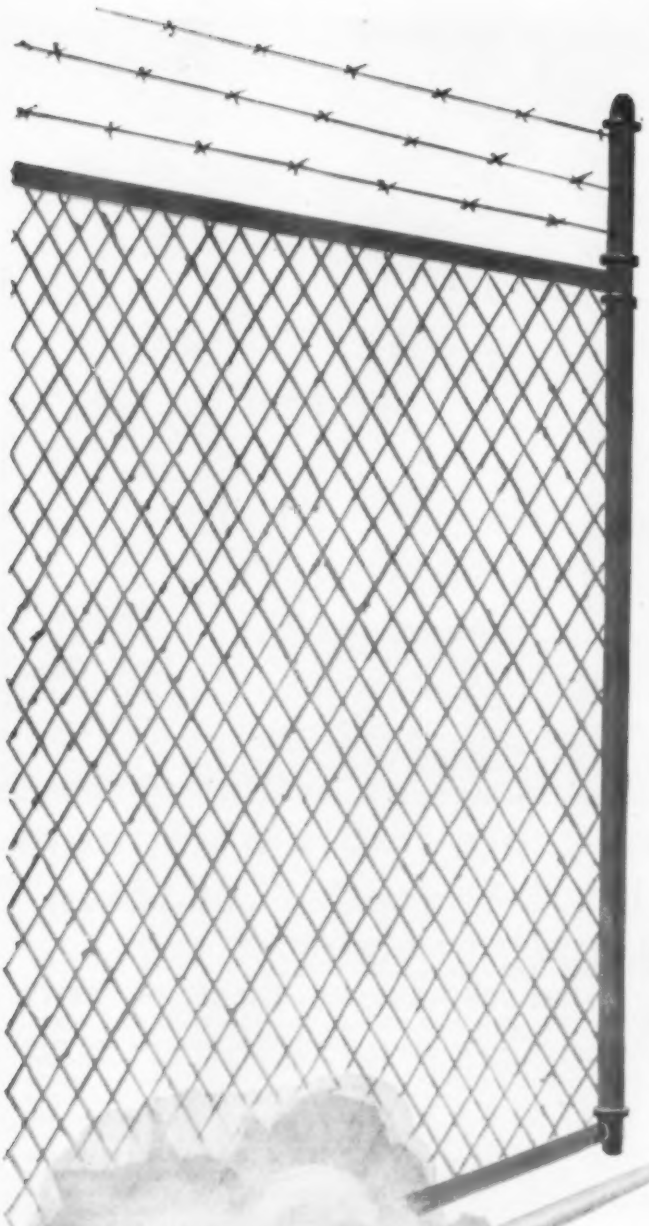

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district meeting, Biltmore Hotel, Los Angeles.

26-28 Chemical Institute of Canada, annual conference and exhibition, Royal York Hotel, Toronto.

27-29 Annual Short Course in Gas Technology, Texas College of Arts and Industries, Kingsville, Tex.

28-29 Rocky Mountain Oil and Gas Association, refining committee annual meeting, Cody, Wyo.

JUNE

2-4 University of Texas, short course and conference on automation and computers, University of Texas campus, Austin.

2-4 Petroleum Electric Power Association annual meeting Texas Hotel, Fort Worth.

5-7 National Oil Scouts and Landmen's Association, annual meeting, Mayo Hotel, Tulsa.

8-11 American Petroleum Institute, Division of Transportation, annual tanker conference, Greenbrier Hotel, White Sulphur Springs, W. Va.

8-13 Society of Automotive Engineers, summer meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

10-12 Appalachian Underground Corrosion Short Course, School of Mines, West Virginia University, Morgantown, W. Va.

19 Pennsylvania Grade Crude Oil Association, annual meeting, Penhills Club, Bradford, Pa.

23-25 Interstate Oil Compact Commission, midyear meeting, Hotel Utah, Salt Lake City.

25-26 Western Petroleum Refiners Association, Mid-Continent regional technical-industrial relations meeting, Broadview Hotel, Wichita.

24-27 Canadian Gas Association, fifty-first annual meeting, Manoir Richelieu, Quebec.

22-27 American Society for Testing Materials, annual meeting and exhibit, Hotels Statler and Sheraton-Plaza, Boston.

28-July 2 Petroleum Equipment Suppliers Association, twenty-third annual meeting, Chateau Frontenac, Quebec.

JULY

23-26 Wyoming Geological Society, thirteenth annual field conference, Powder River basin.

AUGUST

11-14 Society of Automotive Engineers, National West Coast meeting, The Ambassador, Los Angeles.

25-27 Appalachian Gas Measurement Short Course, University of West Virginia, Morgantown, W. Va.

SEPTEMBER

10-12 National Petroleum Association, fifty-sixth annual meeting, Traymore Hotel, Atlantic City, N. J.

15-16 Independent Natural Gas Association of America, annual membership meeting, Roosevelt Hotel, New Orleans.

24-25 Western Petroleum Refiners Association, Rocky Mountain regional technical-industrial relations meeting, Henning Hotel, Casper, Wyo.

29-Oct. 3 Society of Automotive Engineers, national aeronautic meeting, aeronautic production forum, and aircraft engineering display, The Ambassador, Los Angeles.

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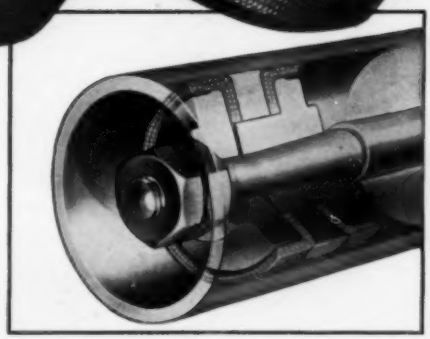

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the OIL AND GAS JOURNAL

TULSA, OKLAHOMA

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JOURNALLY SPEAKING

Obsolete Intelligence

NOT LONG AGO we read an article about "educational obsolescence" which discussed the idea that an engineer 15 years out of school is of little use to anybody because science and technology have advanced so fast that industry is now using things that were never even heard of, much less taught, when he was getting his education.

The obvious answer to that is to keep on studying after you get out of school. Right here we could point a moral to the effect that the best way to keep up with technical progress in the oil and gas industry is to be a faithful reader of our favorite oil publication. But all our readers know that anyway so we'll hasten on to an example that amused us.

In our library we stumbled across a special edition of The Oil and Gas Journal put out in the spring of 1919—exactly 39 years ago—telling what marvelous progress the industry had made under the spur of just-ended world war.

Included was an article on "natural-gas gasoline," giving just all about the subject our then meager staff could collect. It told how the sudden demand for gasoline had induced a wide variety of experiments to squeeze the juice out of gas, with the result that much was being learned about the art.

The technology was covered in about three paragraphs, the essence of which was that "methane cannot be liquefied and consequently gasoline cannot be obtained from lower hydrocarbons, ethane, propane, butane, etc." The writer then added:

"It is assumed by those who have made a careful study of the subject that a great deal of the product made from natural gas is lost, from the fact that the gas itself has not been scientifically tested before the attempt was made to convert it into liquid form."

If the man who made that assumption is still alive—and he very well could be—he could check its correctness with the articles on chromatography in this issue of the Big Yellow Book. At last the industry is really making a scientific analysis of the gas itself, not only before but during the "attempt to convert it into liquid form."

And yet only 2 or 3 short years ago "chromatography" was only a strange word to almost anybody in the gas-processing industry. Which shows how fast intelligence can become obsolete and how necessary it is to read every issue of—well, you get the point.

That same 1919 article contained what purported to be a survey of natural-gasoline plants in the United States. Our reporter undoubtedly did his best. He stated that 1915 had been a year of unprecedented construction, and at the end of that year it was estimated that there were more than 400 plants in the country, more than half of them in Pennsylvania and West Virginia.

He then supplemented this with whatever scattered reports he had been able to collect regarding subsequent building in various states and wrapped it up with this statement:

"On December 15, 1917, so far as it has been the writer's ability to ascertain, there were 175 casing-head-gasoline plants in Oklahoma. If the number given is not correct, it is because the proper information is not at hand."

Now there's honest journalism for you. We are sure that our 1919 predecessor didn't hold back anything, and that if his survey was incomplete it wasn't his fault.

But oil reporting has made as much progress since 1919 as field processing has. Today our staff is not only larger and more efficient, but much more experienced in making surveys of industry facilities and in reporting on technological developments like chromatography.

Just look at the survey of field processing plants in this issue. We think it is complete and accurate. But if it isn't, we can do no better than repeat that 1919 alibi: "If the number given is not correct, it is because the p r o p e r information is not at hand."

—*Henry D. Ralph.*

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Another imports "study" evades the real issue

As debate over oil imports reaches a climax the arguments tend to be based more on fury than on fact, directed more at emotion than at logic.

Both the pros and cons display this tendency. Some writings in favor of limitation have thrown more heat than light on the subject and added little to public understanding of the complexities of the problem.

Likewise the opponents of limitation often exude more heat than light. The latest example of this is a study of the shift of world petroleum power away from the United States, prepared by an independent agency and being given wide distribution by a major importer.

THIS DOCUMENT gives some interesting statistics and then states or implies some startling conclusions entirely unsupported by those statistics. It should scare the daylights out of the casual reader.

A person unfamiliar with the industry would get the inference that the United States is completely washed up as an oil producer, that operators are turning their backs on this country in droves, and that America's foreign oil investments will be wiped out unless our import door is opened wide.

It raises a shortage scare, concludes that the only hedge is to "rely on" imports, and implies that anything short of free trade will force consumers to pay "skyrocket prices."

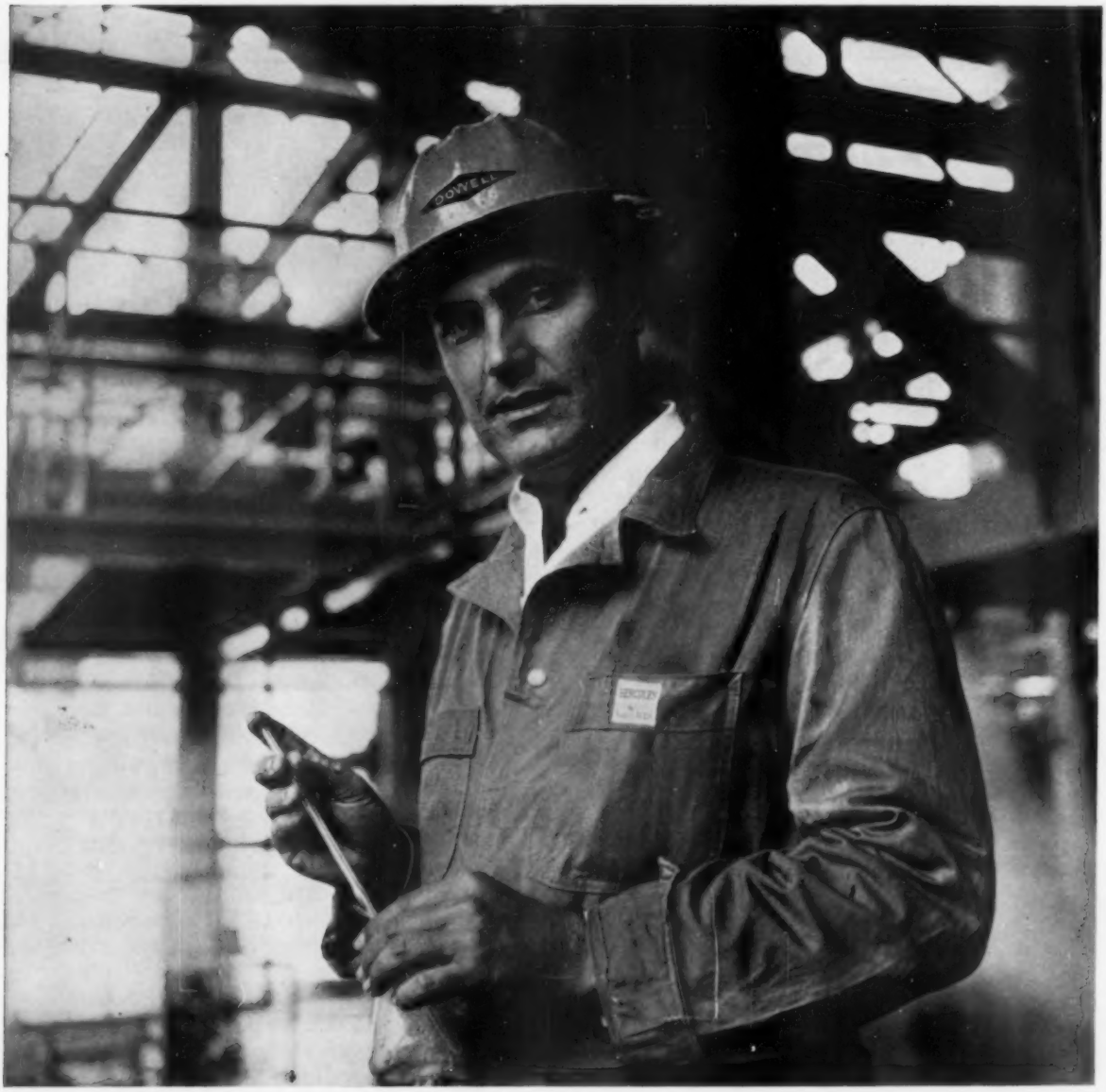
It states that it is not in the public interest to "shut off" imports. We know of no one who wants to shut off imports completely. The issue is not between complete free trade or complete embargo, but over the direction and degree of change in the present limitation.

The document begins to talk sense when it says this country should face up to the problem of its future oil supply, and that the public has a stake in avoiding the wrong course. It approaches the guts of the problem when it warns against "overrestriction" of imports and urges using foreign oil "to the necessary extent."

THERE'S THE REAL ISSUE—how to determine the optimum point between overrestriction and imports to the necessary extent. But very little real study has been given to it by anybody.

For the nation's future security, imports should be just low enough to encourage the domestic industry to continue exploration, conservation, and maintenance of reserves, just high enough to prevent consumers from paying higher prices than this domestic security is worth.

Many factors are involved in determining that point, and the point may change from year to year. We badly need some objective yardsticks for keeping that point within a tolerable margin of error. The current partisan arguments for and against imports are of little help with this problem.



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The OIL AND GAS JOURNAL

Court May Have Done Oil a Tax Favor

That's the view of many on ruling that carved-out oil payments are not capital gains. Some oil men think punitive legislation would have hit industry if the privilege continued. Anyway, other payments not hurt.

THE SUPREME COURT decision last week removing the tax lure of certain types of carved-out oil payments won't jolt the oil industry.

Many lawyers and bankers serving the industry, in fact, view the decision as a good one, legally sound, and probably one that will help the oil industry in the long run.

What the court held was this: Cash derived by oil men from selling a part of their future production is taxable at ordinary income rates and not at the much lower capital-gain rate.

Internal Revenue officials quickly pointed out the decision will not affect many other types of oil-payment deals. Usually these involve outright sales of oil properties for which payment is made out of future production.

The decision specifically applies only to cases where the owner of an oil interest temporarily assigns it for cash or property or to satisfy a debt, getting the full interest back when the obligation has been met.

The legal test apparently is whether a taxpayer who disposes of his right relinquishes it permanently or is to get it back again.

What's good about it . . . Lawyers interviewed by The Oil and Gas Journal who termed the decision sound took this tack:

Had the oil man in these cases retained his interest he would have treated the return as ordinary income. And the return is treated as ordinary income when it again reverts to him.

They agreed with Justice Douglas who ruled such a temporary assignment of interest is not a real conversion of a capital investment. Since it isn't, it does not qualify for capital-gains treatment.

"The capital-gains provision has always been against artful devices," Douglas noted in his opinion. "These arrangements seem to us transparent devices. Their forms do not control. Their essence is determined not by subtleties of draftsmanship but by their total effect."

Some lawyers had given private opinions all along that the capital-gains tax status of carved-out payments was doubtful.

They added the Supreme Court ruling may have saved the oil industry some future embarrassment and maybe punitive legislation.

These attorneys felt the oil-payment device was a blatant tax loophole which was becoming increasingly popular for oil men in upper income-tax brackets or estates hard-pressed for cash to pay inheritance taxes.

They feared it might spread throughout the industry, would cause resentment among other business interests not able to gain such privilege, and might lead to legislation knocking out the practice.

If oil-tax practices should become a hot issue in Congress, these men feared the lawmakers would also manhandle the depletion allowance, which they view as a legitimate practice and sound economic principle for the industry.

The cases involved . . . Five separate groups were parties to the case which went to the Supreme Court.

The Justice Department brought the case to the high court on appeal from the Fifth U. S. Circuit Court of Appeals of New Orleans. The appeals court had held the payments could be taxed at the capital-gains rate.

Use of the oil payments to get capital-gains privilege is not new to the industry. The practice began in the early 1930s. It was abandoned later, however, after an adverse ruling by Treasury Department lawyers. The plan was revived after World War II and really took an upturn with the appeals court ruling more than a year and half ago.

Justice Department lawyers in appealing the case told the court that, if the New Orleans ruling stood, many millions of dollars in revenue would be lost to the federal treasury.

The Government stated oil interests were turning more and more to use of oil payments as a device to turn ordinary income into capital gain.

Five parties to the suit were P. G. Lake, Inc., Tyler, Tex.; the estate of Thomas O'Connor, San Antonio; a family group headed by William Fleming of Fort Worth; John Wrather, Longview; and W. F. Weed of Beaumont.

Internal Revenue Service officials, however, said the same issue is involved in 43 other cases before them. Many millions of dollars were at stake.

An example . . . The Lake case is typical.

The corporation was indebted to its president, P. G. Lake, for $600,000. To cancel the debt, the firm assigned to Lake an oil payment right in the amount of $600,000, plus 3% interest on the unpaid balance each month.

The entire sum was payable out of 25% of the oil from the company's working interest in two Texas oil leases. The assigned oil-payment right required slightly more than 3 years to pay out.

In the other cases:

Executors of the O'Connor estate sold an oil-payment right to raise money to pay federal and state taxes.

Members of the Fleming family made oil-payment assignments in trade for real estate rather than cash.

Wrather sold oil-payment rights to the Indiana Farm Bureau Cooperative Association.

Weed transferred a sulfur-payment right.

The decision may prove costly to these parties and some of the other

43 cases before the Internal Revenue Service. The lump-sum payments become taxable as ordinary income in the year received. That may push the taxpayers into much higher brackets than if they had taken the income year by year over the period of assignment.

IRS officials said they will check all transactions on which the statute of limitations has not run or been waived. Some of the cases before it run back 8 years or more.

What's still left . . . Oil-country bankers say oil men still have several different types of oil-payment plans not affected by the court decision.

Some give capital-gain tax privileges. One frees oil income from paying any tax at all.

They include:

. . . The A.B.C. plan.

. . . The reserved oil-payment plan.

. . . The carved-out oil-payment plan to establish year-end income or to get a quick payback on development costs.

The A.B.C. plan . . . This usually involves a dummy corporation created to acquire and sell property.

Under it, Company A sells a property to Company B, the dummy, say for $1,000,000. Company A gets cash and steps out of the picture entirely. It can apply capital-gains tax rates to the cash because it has liquidated assets.

Company B then sells the property to Company C for $500,000 and an oil-payment right of $500,000 bearing an interest factor of say 5½%. The oil payment is met from a percentage of production from the property now being operated by Company C. Operator can apply rest of the production to meet his costs.

If production exceeds cost, it's an ordinary profit. If operator sustains a loss on the new property, he must capitalize it as a part of the cost of acquiring the property.

Company B can take two routes to dispose of the oil-payment right. He can borrow on it or sell it. He will sell or borrow at a lower rate of interest than the payment bears and keep the interest margin as his profit in the deal. At this stage Company B is given a quiet death.

This plan was preferred at first by investment bankers and insurance companies because it created a mortgage-type payment against the property. They even usually financed the dummy corporation.

Reserved payment plan . . . This is a popular variation of the A.B.C. oil-payment plan. It doesn't involve a dummy corporation, but otherwise it is very similar.

An excellent example of this plan at work is the sale of Houston Oil Co. of Texas for $200 million 2 years ago (OGJ, June 11, 1956, p. 84).

Houston Oil got $73.5 million cash from Atlantic Refining Co. and $125 million for a production assignment taken by a group of investors.

This oil reserve is paid out of 85% of production from the property. When the obligation is met, Atlantic as operator will get all the production. The oil-payment, however, is not a financial obligation of Atlantic. This means if something should happen that production wouldn't pay off the obligation, Atlantic could not be sued for judgment.

Carved-out payments . . . These also take several varieties. It was a variation of this plan involved in the Supreme Court cases.

Under it, an oil operator carves out part of his anticipated production and sells it for a lump sum, usually at a discount or with an interest factor. He still retains the property, operates it, and gets the full production when the assignment is paid off.

Oil operators can still use carved-out oil payments to establish year-end income or recover quickly their development costs.

Year-end income . . . This plan works like this: An oil man in developing a lease has laid out more cash for intangible costs and drilling than he can charge off to income for the year. If he doesn't charge them off in the year, he will not be able to recover them the next year.

So the operator carves out part of his future production equalling the intangible and drilling costs and either sells the production right or borrows on it at the bank. The money he gets establishes an income great enough to allow him to recover his costs.

Another variation permits the operator to carve out part of future production equal to cost of drilling and equipment on a property. He sells this payment or borrows on it and the money is not even considered as income and is not taxable.

There are several limitations to this plan. The operator also is not allowed to charge off depreciation in later years on his equipment or recover development costs in other ways. The plan allows the oil man to recover investment in intangibles, drilling, and equipment quickly so he can use the money in further operations.

These payment plans so far have not been challenged.

23.9-Cent Gas Price Approved

A FEDERAL Power Commission examiner has approved a record price for a big package of Louisiana gas for Texas Eastern Transmission Corp.

Examiner Glen R. Law authorized four producers to sell 100,000 M.c.f. daily to Texas Eastern for 23.9 cents per M.c.f., including 1.3 cents for state gathering taxes.

To handle the gas, Texas Eastern and the affiliated Texas Eastern Penn-Jersey Transmission Corp. will add a record 214,890 hp. to their compressor capacity—the largest such expansion in their history.

Gas supply . . . The high-priced gas will come from Rayne field, Acadia Parish, South Louisiana, to which a 22-mile, 14-in. line will be laid.

Producers are Continental Oil Co. and associated companies and individuals; M. H. Marr, Dallas; Sun Oil Co.; and General Crude Oil Co.

Intervenors sought to have the rates reduced or investigated. But the examiner ruled that the producers had shown the reasonableness of the 23.9-cent initial price.

The figure is 1½ cents greater than the 22.4 cents paid by Tennessee Gas Transmission Co. to the CATC offshore group. The commission ordered TGT price cut to 18 cents, but CATC made the contract price stick by refusing to accept a certificate on this basis.

FPC then decided that the public need for the large amount of gas involved was more important than the initial price (OGJ, July 1, 1957, p. 84).

Station expansion . . . Texas Eastern was granted authority to install 141,780 additional horsepower in existing stations and build one new 2,200-hp. station, plus 59 miles of 30-in. loop and the Rayne lateral.

Penn-Jersey was authorized to build five new stations in Pennsylvania and add 4,000 hp. to its Delmont, Pa., station for a total of 71,000 hp. The combined projects will cost $48,632,000.

The large horsepower program will include expanded use of 15,000-hp. electric motors, largest on any pipeline, and gas turbines at centrifugal stations as well as engine-driven reciprocating units.

Offshore Bidding Set at Last

. . . by California agency. Leases to be advertised in May and bids opened in July. Cash bonus will decide winners.

AFTER almost a year and a half delay, California is back in the offshore leasing business.

The State Lands Commission last week approved five parcels between Point Conception and Elwood field off Santa Barbara County for leasing.

The bid factor will be a cash bonus. Royalty rates will vary from 16⅔% for wells making 100 bbl. daily or less up to a maximum of 50% for wells making 500 bbl. or more.

The parcels are 3,840 acres each. The first parcel begins 1½ miles west of Elwood. Then there's a 4-mile gap to the next 3,840-acre parcel and then another 4-mile gap and another parcel. This alternating pattern prevails until the final parcel ends at a point about 3 miles east of Point Conception.

The first three leases are between Gaviota and Elwood, an area where drilling from piers is prohibited and offshore structures must be at least 1 mile from shore. The most westerly two parcels can be drilled in any manner the operator chooses to use.

The timetable . . . Frank J. Hortig, executive officer of the State Lands Commission, said advertisements calling for bids probably will be published around the first of May. Bids will be opened 60 days after the ads have been published.

The commission staff will study the bids and recommend acceptance or rejection at the next commission meeting.

The same general Santa Barbara area was offered for bidding under the old rules more than 1 year ago but was removed from the market when the state decided to increase the royalty rates. At that time, the acreage was offered for a cash bonus with a flat 12½% royalty.

Some changes . . . The commission paved the way for the new offering of parcels by approving a new lease form.

The new form is substantially the same as that circulated recently among West Coast oil companies prior to being submitted to the commission (OGJ, March 24, p. 98). The only significant changes were these:

. . . The lessee is not to be held responsible for nonnegligent damage to a reservoir. The earlier draft held the lessee responsible for all reservoir damage regardless of whose fault it was.

. . . Drilling operations were redefined to mean actual bore operations such as coring, drilling, logging, etc.

. . . Thrown out was a clause in the earlier draft giving the commission authority to order repressuring operations when subsidence threatened. The lease now provides for hearings when subsidence occurs. The commission can order suspension of operations in a lease until a mutually agreeable repressuring program can be worked out between the state and the operator.

Long Gas Bill Hit

by IPAA on eve of Chicago meeting. New plan sought.

INDEPENDENT PRODUCERS meeting in Chicago next week will search for new ways to bring an end to Federal Power Commission regulation.

The Independent Petroleum Association of America never has and will not now support halfway measures as a substitute for the Harris gas bill, Russell B. Brown, general counsel, told IPAA members last week.

The bill offered by Sen. Russell Long (D-La.) to lift federal controls from producers of less than 2 billion cubic feet annually, does not meet the needs of the industry, he said.

The same type of measure was offerred in 1956 in an effort to defeat the first Harris bill, Brown pointed out. It was offered again last year as a substitute for the present measure, which now has no chance of passage this year.

Brown cited three main reasons why the IPAA does not support the limited exemption of independent producers. He said the bill would:

. . . Abandon the basic principle "that the production and gathering of natural gas and the sale thereof is a local function which should not be regulated by the federal Government."

. . . Apply federal jurisdiction on the basis of the size of the producer rather than the function performed.

. . . Provide regulation of large producers with more than 90% of total interstate sales, "thereby indirectly regulating the producers of 2 billion cubic feet per year or less even though nominally exempted."

The only advantage to the smaller producers, Brown said, would be relief from the burden of FPC's reporting and administrative rules.

California Prices Drop

. . . for heavy crudes and fuel oil. Loss of markets in Orient and inroads of natural gas help cause oversupply.

THE CONTINUING oversupply of fuel-oil in California last week triggered a break in posted prices of heavy crude and fuel oil in the Far West.

Price cuts on heavy crude ranged from 2 to 20 cents a barrel.

Price of fuel oil was cut 20 cents a barrel.

Standard Oil Co. of California was the first to announce the fuel-oil cut and accompanied it with lower postings on heavy crude. General Petroleum Corp. quickly followed. Other majors now are also expected to follow the pattern.

This is the first major cut in crude prices on the West Coast this year. A small buyer—Century Oil Co.—cut its postings last month by 60 cents a barrel in the Los Angeles Basin. Its action only brought its postings in line with the price it had been paying all along. Heavy crudes have been selling for 50 cents under postings on the spot market for several months.

Under the new postings, all crudes of 14° gravity or lower were cut 20 cents a barrel. Most of the postings for 25° to 25.9° were lowered 2 cents. For the in-between gravities, the cuts were increasingly larger on the lower gravities. Higher gravities were not changed.

Example of California Standard's new prices: For 24°-gravity crude at Signal Hill new posting is $3.02, down 3 cents; at Wilmington $3.09, down 4 cents; at Huntington Beach $3.06, down 4 cents. For 14°-14.9°-gravity crude at Signal Hill the posting is $2.49, down 20 cents; at Wilmington $2.58, down 20 cents; and at Huntington Beach $2.56, also down 20 cents.

The cut on fuel-oil price was the second this year. California Standard announced a similar 20-cent cut in January.

Trend reversed . . . These price cuts in heavy crudes reversed a trend of the last several years on the coast.

For a time the heavy crudes had been gaining in favor, due largely to increases in coking capacities on the West Coast.

This has been upset, however, by depressed market conditions in the past year for heavy fuels. Exports to the Far East have fallen off to virtually nothing as Japan and other industrial users switched their fuel-oil purchases to the Middle East.

Natural gas also has made very rapid inroads into the fuel market. Economists estimate natural gas has supplanted the equivalent of 50,000 bbl. daily of fuel oil in industrial usage in the Pacific Northwest.

Residual fuels, however, haven't been the only sufferer in the current oversupply. For example:

. . . **Total stocks** rose from 103,024,000 bbl. at the end of March last year to 146,250,000 bbl. at the end of March this year.

. . . **Residual stocks** rose from 12,555,000 bbl. to 28,500,000 bbl.

. . . **Crude stocks** went up from 30,500,000 bbl. to 44,000,000 bbl.

Signs lately indicate a leveling off is near between supply and demand in nearly every category except fuel oils. These continued to pile up at the rate of 43,000 bbl. daily last month. Crude, stove and diesel oils, and gasoline stocks stayed even.

Heavy production cutbacks by major California operators, particularly in the heavy-crude fields, have been ordered in an attempt to help the stock position. The cuts are now spreading to smaller producers.

Other price cuts . . . Pennsylvania Grade oils also took a 25-cent a barrel cut.

Buyers blamed excessive inventory for the action, taken by both Quaker State Oil Co. and South Penn Oil Co.

The new prices make Bradford district oil $4.15 a barrel in both Bradford Transit Co. and in National Transit Co.; Middle district-grade oil $3.97 in National Transit Co.; Pennsylvania Grade oil in National Transit Co. $3.68; and Pennsylvania Grade oil $3.50 in Eureka Pipe Line Co.

The cut is the second this year and represents a 73-cent cut absorbed by Pennsylvania Grade crude since January 1957.

Prices of condensate were cut in Texas, Oklahoma, and New Mexico by other companies, following a trend which now has become nearly universal. The lower postings were made by Phillips Petroleum Co. in Texas and New Mexico, by Standard Oil Co. of Texas in West Texas, and by D-X Sunray Oil Co. in Oklahoma.

Texas Cuts Allowable Again

TEXAS OIL producers will undergo still another test in oil production next month—and at their own behest.

The Texas Railroad Commission, under heavy prodding by the state's independent producers, retained April's 8-day producing pattern for May. Since there is one more calendar day in May, this means an initial daily allowable of 394,537 bbl. for May—42,537 bbl. daily under the allowable as of April 12.

In backing up the independent position, the commission went against the wishes of a large majority of crude-oil buyers in the state. Only 2 of 12 sought an 8-day pattern. Four asked for 9-day, five for 10, and one for 13. All indicated they had been drawing from stocks on the April production rate and would be forced to continue to do so in May.

Independents pointed out there now is no pipeline proration in Texas for the first time in many months. To go back to anything over an 8-day allowable for May would mean an early end to benefits that independents have gleaned from this situation.

Pushing hard for an 8-day pattern for May and advocating that the same pattern be adopted for at least 2 more months, was French Robertson, Abilene, past president of the Texas Mid-Continent Oil and Gas Association.

Indications are that the 8-day pattern set for April is beginning to pull down sharply on crude stocks. Distress oil in the state has now officially been dried up. The May allowable should have the effect of emphasizing the current pull on stocks. And independents are hopeful that the stocks situation can be stabilized sufficiently within the next 30 to 60 days to permit resumption of more-normal production allowable.

In allowable actions by other states:

. . . **Louisiana** will cut about 35,000 bbl. daily. Conservation Commissioner John B. Hussey indicated the cutback will be achieved by reducing the depth-bracket allowance from 33 to 31% of the March 1953 rate.

. . . **New Mexico** left allowables unchanged for the southeast section but increased production for the northwest. The normal unit allowable in the southeast for May will be 33 bbl. daily, that for the northwest will be 50 bbl. daily, up 15 bbl. from April. Result will be a state-wide allowable of 316,580 bbl. daily, a 12,925-bbl. increase.

Oil Property Sold

in second major transaction at Texas' Dora Roberts field.

ANOTHER BIG SLICE of the oil-rich Dora Roberts field of West Texas has been sold for a reported $8 million.

Mr. and Mrs. Frank Waters, Houston, sold a portion of their mineral rights in the 20,000-acre field in Midland and Ector counties. Largest interest was acquired by United States Steel Corp. and the Carnegie Pension Fund.

Other purchasers included the trustees of Princeton University and Swarthmore College; trustees of J. Walter Thomson Co. Profit Sharing Trust; and Guarantee Trust Co. of New York, as trustee for Scott Paper Co. Retirement Fund.

The sale involved two-thirds of the couple's retained mineral rights in the northeast and southwest quarters of each section.

Cities Service operator . . . This was the second big sale of the month at the multizone field.

Forest Oil Corp., former operator of the field, sold its share to General American Oil Co. of Texas for $16 million earlier this month (OGJ, Apr. 14, p. 76). Cities Service Oil Co., major owner, assumed operations of the field after the sale.

The General American purchase involved one-fourth working interest in three-fourths of the prolific field. Recoverable reserves for this share are estimated at about 13 million barrels of oil and condensate and 60 billion cubic feet of gas.

Forest and Cities Service first leased three-fourths of the ranch in 1953. Discovery of oil was considered the most significant strike in West Texas in 1954.

Boundary Dispute Scheduled

THE SUPREME COURT last week laid out a timetable for the big gulf states' boundary case.

The court will hear 13 hours of argument on the issue of the states' seaward boundaries. The Justice Department was given half of the time. Texas, Louisiana, Alabama, Mississippi, and Florida will divide the remaining 6½ hours.

Meanwhile, the court ruled, the department is to file its brief by May 15. The states have until August 15 to submit their briefs, and the Government's reply brief must be sent in a month later.

The suit previously was set down for argument next October 13.

watching WASHINGTON

. . . with Bertram F. Linz

• Jet-fuel purchases to soar

MILITARY OIL LIFTINGS for the current fiscal year will be around 222,000,000 bbl. In fiscal 1957 they were 244,500,000. The main reason for the drop of nearly 10%—economy.

But 1959, which starts July 1, will see military needs at a new peacetime high, maybe as much as 265,000,000 bbl.

Thereafter, barring war, there will be a slow decline, totaling 3% by 1963.

More important than the totals, however, will be the changes in the buying pattern. Here are the trends, as foreseen by the Military Petroleum Supply Agency:

Jet fuel, 1% of total needs in 1948 and 40% now, will account for over 55% of military consumption by 1963.

Aviation gasoline, at its peak in 1957, falls off this year. It will recover most of its ground in 1959. After that, needs will drop about 11%.

The needs for motor gasoline and diesel fuel will continue to decline gradually. Navy special and other products will remain fairly constant but slightly under the 1959 level.

• Oil defense study is under way

A YEAR-OLD PLAN to work out a long-range national policy to assure adequate oil supplies in time of war is just getting off the ground.

By the end of the year, however, Mobilization Director Gordon Gray hopes to have the basic figures on the industry's capacity to produce, refine, and transport oil through 1975.

The figures will provide a base for any steps needed to make sure that war needs for oil could be met from relatively "safe" sources.

Gray had the idea for the study almost from the time he took office a year ago. He told a Senate committee last October that no real analysis of oil needs for an emergency has ever been made.

The probability that the next war will start with a blitzkrieg attack on our oil facilities has changed military thinking about defense. Our oil resources and ability to transport must be "reassessed" in the light of damage which could be expected from such an attack, Gray said.

• Oil taxes feed federal coffer

THE U. S. TREASURY collected a neat $1.8 billion from the four federal taxes on oil last year.

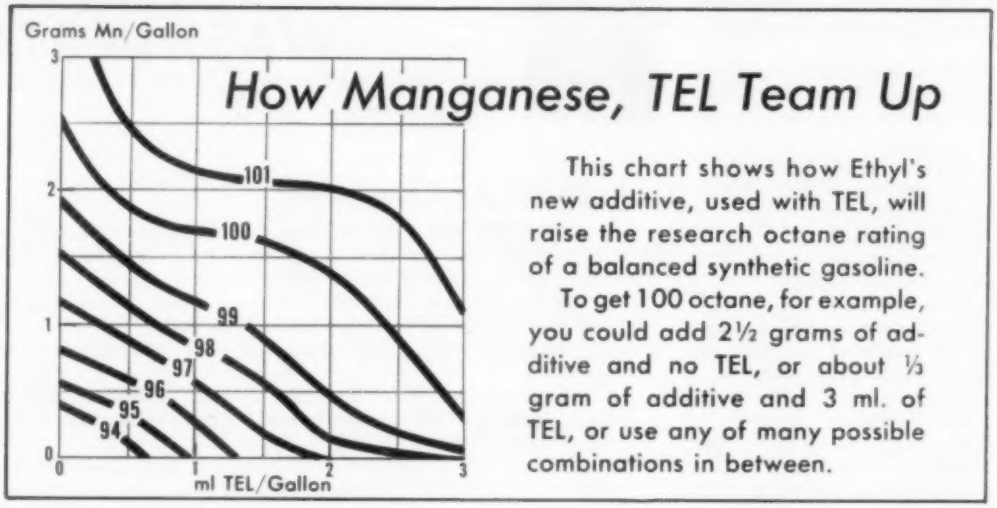
Add the income, social security, and unemployment insurance taxes paid by companies and individuals and it can be seen that the industry and the people in it account for a sizable chunk of the $82 billion collected from all sources in 1957.

The oil-tax collections last year were $448 million more than was secured in 1956, when $1.3 billion was recorded.

A good part of this increase, however, came from the higher gasoline and diesel-oil taxes earmarked for the big highway program, which went into effect in mid-1956.

The gasoline levy, 2 cents per gallon before June 30, 1956, and 3 cents thereafter, returned $1,625.5 million last year against $1,192.3 million in 1956. The tax on diesel oil, at the same rates, brought $45 million against $28.9 million.

The levies of 6 cents per gallon on lubricating oil and 3 cents on cutting oils returned $73.8 million against $73 million. But the return from the 4½% tax on pipeline movement fell off, to $35.5 million from $37.4 million.


Grams Mn/Gallon
How Manganese, TEL Team Up
101
100
99
98
97
96
95
94
0
1
2
3
ml TEL/Gallon
This chart shows how Ethyl's new additive, used with TEL, will raise the research octane rating of a balanced synthetic gasoline.
To get 100 octane, for example, you could add 2½ grams of additive and no TEL, or about ⅓ gram of additive and 3 ml. of TEL, or use any of many possible combinations in between.

1. New Additive Looks Commercial

IN A COUPLE OF YEARS, refiners are going to have a new factor to consider in octane economics.

By then it appears that Ethyl Corp. will have available commercial quantities of its new manganese antiknock additive, AK-33X.

When the new additive was first announced last summer, Ethyl couldn't say just how it might fit into the motor-gasoline picture (OGJ, July 8, 1957, p. 84). But extensive testing since then by oil companies and Ethyl indicates that relatively small concentrations of manganese, when used with conventional tetraethyl lead, will prove competitive with other means for raising gasoline octanes.

In a paper delivered by Ethyl's J. E. Brown and W. G. Lovell at American Chemical Society's national meeting in San Francisco last week, some of industry's questions were answered. But not all.

The particular compound under test is methylcyclopentadienyl manganese tricarbonyl. When used alone, it boosts research and motor octanes of commercial fuels. But its effect is more pronounced when it is used to supplement TEL.

Pure hydrocarbons which show the best response to TEL also tended to show the greatest octane boost from AK-33X. With the research method, paraffins which have excellent TEL response showed even better response to the manganese additive. Olefins showed wide variations in their response to AK-33X as they do to TEL.

Accurate research octane ratings are difficult to obtain on aromatics because they are so high. One test to date—on ethyl benzene—showed a high response to AK-33X as compared with its TEL response. Motor-method responses of pure hydrocarbons, with some exceptions, were about the same with both additives.

Proof of the pudding . . . The test program has progressed to the point of evaluating the new additive in commercial fuels by commercial cars in road ratings by the modified borderline procedure. Thousands of these ratings have been obtained.

Results with three fuels were reported. This road work will not yet permit any definite correlations. But it has pointed up some important findings.

With one commercial fuel, road ratings closely reflected research ratings when AK-33X was used alone or with TEL.

With a second fuel, response from 0.25 g. of manganese per gallon was greater than that shown by either laboratory method. A third fuel showed poor motor response in the lab, but AK-33X response was appreciable at all concentrations.

The work on a synthetic fuel comprising 40% toluene, 30% n-heptane, 20% diisobutylenes, and 10% isooctane might serve as an example of the relative responses from varying TEL and AK-33X doses (see chart).

Antiknock action . . . Research into the mechanism of AK-33X antiknock action indicates that it decomposes and interrupts the chain-branching reactions of rapid combustion or knock, much in the same manner as TEL.

The response of small concentrations of the new additive in combination with 2 to 3 ml. TEL was surprisingly large, however. It may be that the manganese reduces the size of lead oxide particles, increasing their catalytic surface area. Further research may explain this more clearly.

But the results of tests to date lead Ethyl to believe that the new additive will prove competitive at the cost that its commercial production will dictate.

2. New Asphalt Tests Needed

BETTER YARDSTICKS are needed in evaluating asphalt for its various end uses. But just what they should be is not yet clear.

Some traditional opinions and time-honored specifications just don't agree in defining service use. Because they have been around so long, however, they have acquired an acceptance which they don't deserve.

Many research laboratories are whittling away at this problem. In taking

a basic look at the composition of asphalt they are attempting to correlate the value of asphalts in various uses with the types and molecular weights of the complex hydrocarbon, sulfur, nitrogen, and oxygen compounds they comprise.

This is no simple matter. The composition of asphalt is far too complex to permit such correlations, at least at the present stage of technology. But the concerted study of what makes up asphalt may in time give rise to more objective methods for evaluating it.

Contradictions found . . . A few of the inconsistencies in asphalt specifications came to light last week in a symposium at the ACS meeting.

For example, a research team from Standard Oil Co. (Ind.) found some contradictions in the traditional opinions of paving-asphalt quality. They separated various asphalt fractions into asphaltenes, resins, and oils and tested reconstituted mixtures.

They found that the Marshall stability and Hveem cohesion values generally increase with asphaltene and oil content. But these increases in engineering values accompanied large decreases in ductility.

Only asphalts with ductility of 100 or more have been considered superior. The best results from the accepted stability and cohesion tests, however, were obtained from asphalt mixtures with ductility considerably less than 100.

The spot test is another favorite of highway commissions, many of which reject any paving asphalt having a positive spot test. But again, the highest engineering values were obtained on reconstituted asphalts which gave a positive spot.

More research needed . . . Nine papers presented in the asphalt group reported much progress in the separation and study of the many types of components found in asphalts. They also underscored the vast amount of research yet to be done before any practical correlations of composition with performance can be drawn up.

In fact, asphalt is so extremely complex in composition that some doubt exists that any direct correlations will ever be possible.

Meanwhile, the new knowledge resulting from continued study gives refiners a better insight into what crudes they should use and how they should proceed to make products best suited to the many end uses for asphalt.

3. Propylene Purity Stressed

PETROCHEMICAL manufacturers are showing a growing thirst for propylene. But now they want it neat.

The new, large-demand uses for this common refinery byproduct require a high 99% plus purity.

The established chemicals from propylene, such as tetramer, alcohol, glycol, and cumene, can use a dilute feed high in propane content. But the newcomers, particularly polypropylene, need high purity in their feeds.

It is probable that chemical companies will still come to refiners for their propylene, however. About 20 billion pounds of propylene is produced every year as byproduct from thermal and catalytic cracking. Another billion pounds comes from ethylene plants, also as byproducts.

Only 6% of this finds its way into petrochemicals today. The great bulk of recovered refinery propylene goes into polymer gasoline at the rate of 15 to 16 billion pounds per year. These figures were reported to the ACS in a paper by J. A. Sherred and J. R. Fair of Monsanto Chemical Co.

Today's breakdown of end uses lists processes which for the most part utilize feed stocks ranging from 40 to 60% of the olefin (see table).

The Monsanto authors concluded that there is plenty of propylene around but that concentration costs must be watched closely. The most efficient route to high purity is distillation, but this can be costly.

Their analysis led them to advise prospective petrochemical producers needing 99%-plus purity feed stock to consider their raw-material cost at approximately ½ cent per pound under the cost of 95% ethylene.

HOW PROPYLENE IS BEING USED TODAY

Primary product	End use	Quantity*
Tetramer	Detergents, lube additives	500
Trimer	Oxo alcohols, detergents	105
Propylene glycol	Resins, plastics	66
Isopropyl alcohol	Acetone, solvents	800
Polypropylene glycol	Resins, plastics	8
Allyl chloride	Glycerol	59
Cumene	Phenol	51
Epichlorohydrin	Epoxy resins	8
C_4 alcohols and aldehydes	Plasticizers, solvents	100
Miscellaneous	Acrolein, allyl alcohol, chlorinated products	10
Total		**1,707**

*Millions of pounds annually.

4. Octanes Pay Off in Miles

THE UPWARD TRENDS in octanes and compression ratios in recent years have paid dividends to the U. S. motorist.

The increases also have proved sound in conserving our oil resources. More of these benefits are yet to come as octane ratings and compression ratios continue to rise.

These views were voiced at the ACS meeting by E. V. Murphree, H. G. Codet, E. S. Corner, and W. A. Herbst of Esso Research & Engineering Co.

They looked at motor gasoline, past, present, and future from the standpoint of the relationship between the energy obtained from it and the energy which went into making it.

The incremental power increases expected from higher compression ratio engines more than offset the energy costs of making fuel up to a pool research octane of 103, they concluded.

The gasoline bargain . . . They reviewed the period 1930-35 when average premium octanes moved from 76 to 97 RON and average compression ratios rose from 5:1 to 9:1. Aver-

age service-station prices, excluding taxes, went from 16.2 to 21.4 cents per gallon in the same period.

When these prices are adjusted for inflationary trends, the Esso authors showed that gasoline declined from 27.1 cents in 1930 to 22.2 cents in 1955. These adjusted prices coupled with the gains in mileage to show a reduction in cents per mile traveled by the U. S. motorist. At the same time, they pointed out, the customer benefited from a large increase in car performance.

Both mileage and performance will improve if properly designed engines are put to work on the improved fuels of the future. But Esso doubts that benefits can be accompanied by lower gasoline cost per gallon as in the past.

A study of break-even prices for future gasolines assumed that the added efficiency from higher compression-ratio engines would be directed toward better mileage. On this basis, the authors calculated the price a motorist could afford to pay for gasoline at the higher efficiency and higher mileage level.

Starting with a pool average of 94.6 RON gasoline selling for 32.4 cents per gallon including taxes, they projected a break-even price of 40.3 cents per gallon which the future motorist could afford to pay for 104.8 octane gasoline to power his 12:1 compression ratio car. They feel that the industry can stay within this break-even limit.

Greater mileage . . . Prices aside, the Esso team justified higher octanes solely on the basis of energy balance and conservation of natural resources in the form of crude oil.

The added energy obtained from 103 RON gasoline would permit an increase from 17.8 miles per gallon using 94.6 RON fuel to 21.5 miles per gallon.

An increase of about 6% in the energy input to make the higher octane fuel is more than offset by the 21% increase in mileage obtained from it. This interesting picture again assumed that Detroit would divert all future efficiency gains into mileage alone.

Orderly progression of fuel quality and engine efficiency should take the two industries to 12:1 compression ratio cars some time in the future, the Esso group concludes.

This will still return a net profit to the nation in terms of energy balance.

If new processes are adopted with the economy the authors anticipate, it will also be done at a net gain in mileage or its equivalent to the motorist.

"MR. R.G." will make electric-wheel earthmovers like this when . . .

LeTourneau Ends Long "Exile"

AFTER A 5-YEAR absence, R. G. LeTourneau, Inc., apparently can hardly wait to get back into the earthmoving business again.

In 1953, the Longview, Tex., firm sold its earthmoving business and turned to building machines for such purposes as offshore drilling, jungle clearing, and heavy logging.

Included in the $31,000,000 sale to Westinghouse Air Brake Co. was a provision that the original LeTourneau company remain out of the earthmoving field for 5 years. The period ends May 1, and President R. G. LeTourneau says, "we'll be back."

One of the first projects will likely be an electrical-wheel earthmoving machine in which powerful electric motors are geared directly to the center of every individual wheel and to all other points on a machine where power is used.

The system was originally developed by LeTourneau for other machines, but has not yet been introduced in earthmoving.

Arctic Land Play Attracts Nine Firms

THE NEW LAND RUSH north of Canada's Arctic Circle has spread to nearly 13,000,000 acres in the Northwest Territories and Yukon.

The big play, centered around the Mackenzie River Delta and the Arctic Coast, was touched off in March. Since then nine companies have applied for acreage. The latest is Standard Oil Co. of California, seeking 430,000 acres.

Other applicants are British American Oil Co., Ltd., 2,788,000 acres; Shell Oil Co. of Canada, Ltd., 2,649,000; Placid Oil Co. and Hunt Oil Co., 2,482,000; Pan American Petroleum Corp., 1,995,000; Texaco Exploration Co., 1,219,000; Ohio Oil Co., 976,000; and Charter Oil Co., Ltd., and associates, 374,000.

Canada's Department of Northern Affairs has not granted any of the requests yet, pending revision of regulations. But approval is considered only a formality (OGJ, Mar. 31, p. 58).

In addition to the land play in the Mackenzie River Delta area, Shell and Texaco have requested permits for about 2,500,000 acres 375 miles to the southeast.

This acreage is east of the Mackenzie River in the Franklin Mountain area, not far from Norman Wells, where Imperial Oil, Ltd., found oil in 1920.

Drilling on any new concessions would have to be carried out during the short summer season in the Mackenzie Delta area.

Water-Flood Restrictions Mean Little

Study of Texas and Oklahoma projects shows that prorating floods will affect only a small percentage of total oil produced in the states.

RESTRICTION of water-flood production in Oklahoma and Texas will cut the over-all production in the two states only 1% to 2%.

W. E. Stiles of Tulsa makes this claim and then submits the following conclusion:

There is no need for proration of water-flood production in Oklahoma and Texas, but the states should fix a policy that will differentiate between true water floods, pressure-maintenance projects, and salt water disposal projects.

Stiles presented his view at the Mid-Continent district meeting of the API's division of production in Oklahoma City. Last week he resigned as a vice president of Buffalo Oil Co. to form an engineering consulting firm (see Personals).

The issue on water-flood proration has moved to the forefront because of a 1-month experiment by the Oklahoma Corporation Commission, which cut all oil producing wells—including water floods—by 11% during March. The commission granted exceptions for floods building up pressure and later, for April, eliminated the water-flood restrictions entirely.

What was found . . . Stiles said his study shows that in Texas water-flood output is about 4% of the state's total and that only 15,000 to 25,000 bbl. daily is in excess of the normal allowable. The excess is less than 1% of the state's total.

This means, according to Stiles, the "impact of Texas water-flood production on the state's total market is of little, or no, significance."

Likewise, in Oklahoma, Stiles contended water floods are not grabbing an excessive share of the market.

While water-flood output accounts for 18% to 20% of the state's total, only a small number of projects will be producing at a rate in excess of the state's usual minimum allowable of 20 bbl. per well.

His finding: "The daily amount of oil produced in excess of the usual minimum allowable probably will not exceed 2% of the Oklahoma's total daily production."

"If Oklahoma water floods were prorated at even the usual minimum allowable, in order to restrict only a few projects, the amount of curtailed flood production then available for allocation to other types of production would amount to only a small fraction of a barrel per day per well."

W. E. Stiles

Also, he said, if a depth yardstick were used in a water-flood proration formula, the amount of curtailed water-flood production which could be allocated to other wells would be even smaller.

Texas statistics . . . In arriving at his figures on Texas, Stiles said he limited the study of water-flood production to water-injection programs which were started near the end of the primary depletion period. Pressure-maintenance jobs involving water injection were excluded.

He found that most water floods operate at rates well below the allowed prorated level for comparable primary production.

During a 12-day producing period, secondary water-flood output amounted to 121,315 bbl. per day, or about 4% of the state's total. For a 9-day month the production would be about 5%. But the excess above the normal allowable would amount to less than 1% of the total.

Oklahoma story . . . In preparing statistics for Oklahoma, Stiles used official monthly reports of water-flood operators but eliminated salt-water disposal projects "operating under the guise of water floods."

He said the Oklahoma commission has formed no policy stating the difference between true water floods in primary depleted pools, pressure maintenance by water injection, and salt water disposal systems.

"Many operators obtain a water-flood order when in reality the operation is purely the underground disposal of salt water," he said. This frees the operators from allowable restructions in the event the operation increases output above the allowable rate.

Stiles found 357 "true" water-flood projects in Oklahoma during January. Of these only 17—or 4.8%—produced more than the state's 20-bbl. minimum. The total of these 17 amounted to only 10,359 bbl. per day.

Some of the 17 projects in question, he added, could more reasonably be classed as pressure-maintenance projects. And many of the remaining are deeper floods which would not be producing above the allowable if a depth yardstick allowable were used by the commission.

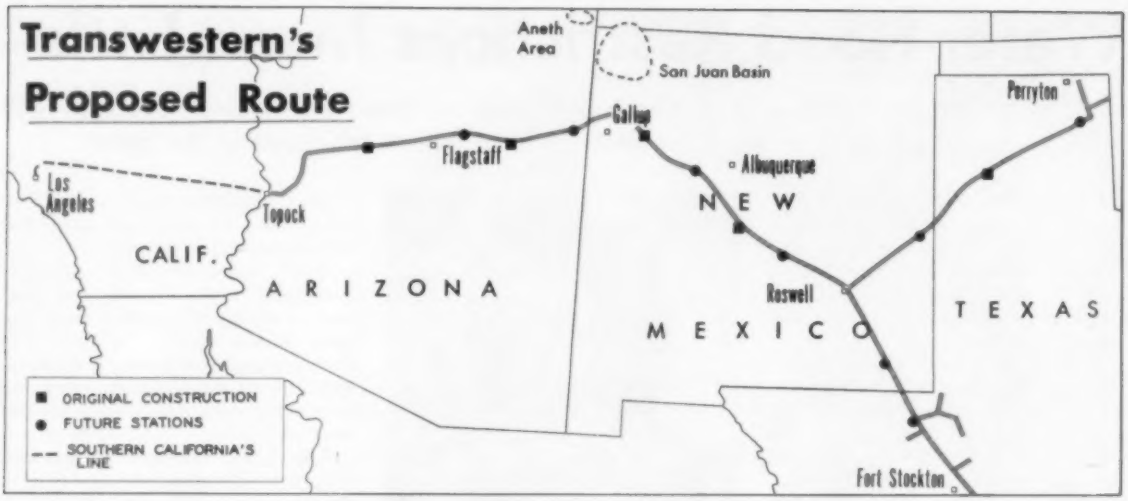
Another view . . . In another water-flood paper presented at the meeting, Burns H. Errebo of Sunray Mid-Continent Oil Co. said regulatory bodies of the major water-flood states grant the flood operators special production privileges because of the "widely held belief" that restrictions will result in a loss of ultimate recovery.

Kansas and New Mexico grant unrestricted allowables, while Texas grants increased allowables to water floods which need them, Errebo said. Oklahoma's policy is undergoing a change "and cannot be predicted."

"It is known that the commission has been at work during the past year on a set of state-wide rules for the regulation of water-flood allowables, and it is therefore probable that the commission will call a general hearing in the near future for the adoption of rules which may be relied upon by water-flood operators in the design and operation of their floods," he said.

Sunray currently is making a study of the effect of cutbacks during March on its water-flood projects in Oklahoma to determine whether there will be a loss in ultimate recovery.

Neither Errebo nor Stiles sought to show that restriction on water floods will reduce ultimate recovery, although their respective companies have a large number of such projects. will be such a loss.



Plans Filed for Gas Line to California

- Transwestern will be locking horns with El Paso Natural both for gas in the field and for markets in California.
- The new line has features that will make it the most modern ever built.

TRANSWESTERN Pipeline Co. last week formally made its bid for a share of the California gas market, one of the nation's most lucrative.

The new company, organized by Warren Petroleum Corp., Monterey Oil Co., and J. R. Butler & Associates, Houston, is shooting for a market whose sole out-of-state supplier is El Paso Natural Gas Co.

Transwestern has asked the Federal Power Commission to approve a $193-million system which would be the most modern ever built. Here's what is proposed:

. . . **A 1,305-mile** system with 24-in. supply laterals from Southwest Texas and the Texas Panhandle converging at Roswell, N. M., with the remaining 670 miles to Topock, Ariz., to be 30-in. Completion is planned for mid-1959.

. . . **Initial throughput** of 350,000 M.c.f. daily to be delivered at Topock, Ariz., on the California border, to affiliates of Pacific Lighting Gas Supply Co., which serves the Los Angeles area. Expansion to 640,000 M.c.f. daily is planned later.

. . . **Six remote controlled** compressor stations powered by engine-driven centrifugal compressors aggregating 52,000 hp. An increase to 125,000 hp. is planned when demand grows.

. . . **A CO_2 removal plant,** costing $8,500,000, with capacity of 180,000 M.c.f. daily in the Puckett area of Pecos County. It will provide 120,000 M.c.f. daily of clean pipeline gas.

Gas supply . . . Transwestern's principal sources of supply will be the Pecos-Terrell counties region of Southwest Texas, the Texas and Oklahoma panhandles, and the San Juan basin and Aneth field region.

The new line will be connected to the most prolific gas-producing areas in the country outside the Gulf Coast. A lateral, not indicated on the map, north from Gallup, N. M., to San Juan and Aneth will be firmed up when additional reserves have been contracted. DeGolyer & MacNaughton, Dallas, are reserves engineers.

Producers will get higher wellhead prices by the entry of another purchaser in these areas. An example of what it can mean is the price of 20 cents an M.c.f. which El Paso paid to get the first big block of Aneth gas committed to a pipeline (OGJ, Dec. 23, 1957, p. 45). This is 6 cents above most new Rocky Mountain contracts.

The proposed Transwestern line follows almost the precise route of El Paso Natural for nearly all its length and they are purchasers in the same areas—sometimes the same fields.

Technical, operating features . . . Transwestern will be the first gas line ever built designed for automatic station operation from the start.

While crude-oil and products pipelines have accepted automation readily, gas-transmission companies have approached it with caution. They preferred the assurance of manpower present at all stations rather than risk lengthy shutdowns, and it wasn't until 2 years ago that a gas line operated a station remotely. Liquid lines started experimenting with unattended stations 30 years ago.

The influence of Gulf Interstate Gas Co., whose engineering affiliate is designing Transwestern and will supervise construction, is apparent in the design and operating plans. It was Gulf Interstate which pioneered unattended compressor stations 2 years ago with engine-driven centrifugals and recently completed five such stations on its system from South Louisiana to West Virginia.

Stations will receive gas at 725 psi. and boost it with a 1.37 compression ratio to 1,000 psi., which is 50 to 150 psi. above normal operating pressures of existing transmission lines.

High-strength pipe will be used on the 30-in. main line. The line will be able to withstand higher operating pressures than any present line. Yield strength of 56,000 psi. compares with the standard grades of X-42, X-46, and X-52 pipe which have yields of 42,000, 46,000, and 52,000 psi. The pipe will have a ⅜-in. wall thickness and weigh 315 tons per mile.

Competitive aspects . . . The Transwestern filing comes at a time when El Paso faces antitrust charges made by the Justice Department.

The charge, filed in U. S. District

Court at Salt Lake City, grew out of El Paso's merger with Pacific Northwest Pipeline Corp., which transmits San Juan, Rocky Mountain, and Canadian gas from Colorado to Washington. The Government charged that the combine might give El Paso a monopoly in gas supply west of the Rockies. It alleged potential competitors might be permanently excluded and producers might be deprived of the benefits of a competitive market.

Transwestern would like to make the monopoly charge a moot question by building a competitive line.

El Paso's position is that the merger is in the public interest, that the economies resulting from coordinated activities would benefit customers, and that dissolution of the merger would mean higher prices and diminishing supplies of gas.

Transwestern organization . . . John R. McMillan, executive vice president of Monterey Oil, Los Angeles, is president of Transwestern Pipeline.

Mills Cox, former vice president in charge of gas supply for Texas Eastern Transmission Corp., is executive vice president and directs Transwestern operations from Houston, the main headquarters. W. B. Padon, Tulsa, Warren vice president, is vice president of the pipeline company; Marshall Brown, Los Angeles, is vice president; J. R. Butler, Houston, is secretary-treasurer; and R. M. Chan, Dallas, who retired last year as vice president of Magnolia Petroleum Co., is consultant.

Board members are McMillan, Padon, Cox, Butler, and Chan.

Steel Set Record in '57

SHIPMENTS of steel products for the oil and gas industry set an all-time high record last year.

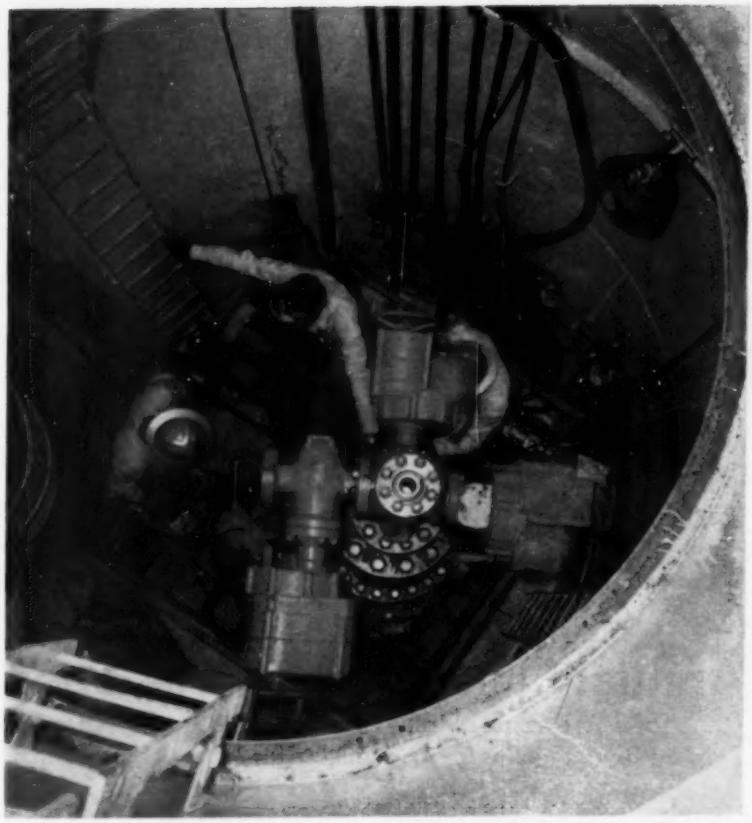
Adding up everything the industry uses, the American Iron and Steel Institute reports that shipments totaled 6,493,750 net tons in 1957.

The best previous record was 5,581,934 tons, set in 1956.

Shipments of oil country goods were more than 2.23 million tons. They represented 3.5% of all shipments.

The steel industry is not yet able to forecast how far short of the 1957 figures this year's shipments will be. But there are indications that they may fall off as much as 30%, even with an upturn in the economy.

Total mill shipments in January 1957 were 7.8 million tons. By December they had fallen off to 5.1 million tons. They increased slightly in January of this year, but still amounted only to 5.2 million tons.



THIS TOP VIEW shows the insides of Shell's new caisson. It may mean . . .

Underwater Completions Near

A METHOD for underwater completion of offshore wells has been developed by Shell Oil Co. and may be tested in the Gulf of Mexico later this year.

Experiments with a caisson technique have been under way for months at Shell's Houston research center. The dry-land tests, conducted by Shell's production technical services division, included a simulated underwater completion.

The bottle-shaped caisson, which gives access to the wellhead and protects it from the sea, has passed its first test. Further details on stressing and other engineering factors are now being studied.

First use of the underwater completion technique is expected to be on a Shell well off the Louisiana coast. A company spokesman said the technical services division was awaiting a suitable location for the installation. First use of the new technique is expected to be in at least 30 ft. of water.

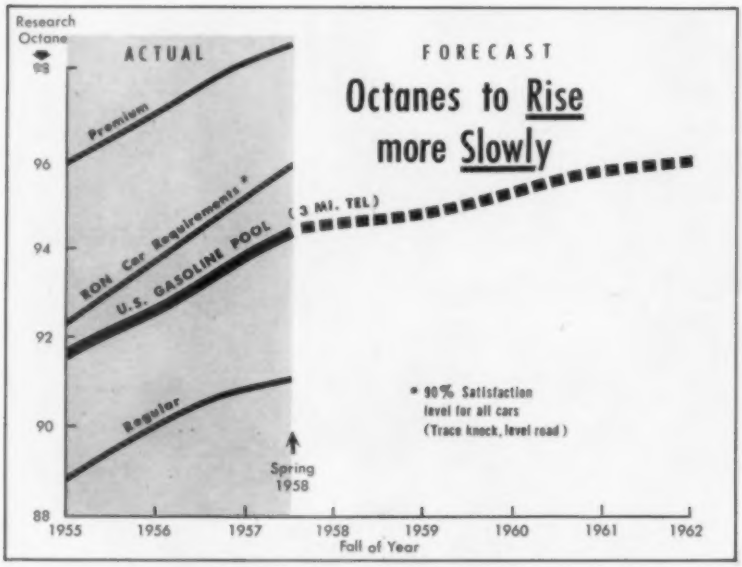
The water-tight caisson is 10 ft. in diameter at the bottom. An access tube 6 ft. in diameter would connect it to the drilling barge or platform. Workmen, using conventional equipment, would descend the tube to set up the wellhead on the bottom of the caisson.

In a recent experiment a drilling crew installed and removed a wellhead and other equipment, including several sets of blowout preventers.

Another method studied . . . Shell also announced that it has been working on a "remote technique" for underwater completions which would not require workmen to go under water.

"Considerable progress has been made in designing the tools and equipment to perform these operations, which will permit completing a well from a floating vessel in several hundred feet of water," the company spokesman revealed.

Shell's caisson method is one of several being considered by the industry to do away with expensive production platforms and make drilling feasible in deeper water. Other offshore operators and service companies have been working quietly for many months on various types of underwater completion techniques.



Annual Octane Rise of .4 Seen

. . . for future years by Ethyl researchers. Gradual changes in refining will help to check the higher octane race.

RAPIDLY RISING octane numbers are becoming a thing of the past. While the antiknock level of pool gasoline is rising sharply again this year, this should be the end.

Instead of annual increases averaging a full octane number, the future should see annual increases in the neighborhood of .4 octane.

This was the prediction made by C. J. Wolf and C. A. Cole of the Ethyl Corp. before the National Petroleum Association meeting in Cleveland last week.

Detroit has said frequently it has no intention of manufacturing cars that will not be satisfied with available motor fuel. This should mean, then, that less-demanding automobiles will be coming off assembly lines in the years ahead.

The nation's gasoline pool has been increasing about 1 octane number per year in recent years—from 91.8 in 1955 to 94.0 in 1957 and an expected 94.8 this year. But—for 1959—Wolf and Cole see only a .1 increase and an increase of only 1.3 octanes from 1958 to 1962. These figures represent research octane number, assuming an addition of 3 ml. TEL per gallon.

What's coming . . . The two Ethyl representatives predict gradual changes in the refining picture in the years ahead. These changes will have varied effects on octane numbers, most pronounced of which will be a slowing down of the trend toward the higher numbers.

Here are some of the changes which refiners may expect:

. . . **Foreign crude.** Wolf and Cole anticipate that runs of foreign crude will increase from 12.1% of total U. S. runs in 1957 to 13.2% in 1962.

. . . **Products.** They expect product yields to increase for jet fuel, decrease for avgas, and remain static for naphtha, kerosene, and distillate. Avgas, they assume, will continue to comprise about 23% straightrun gasoline, 65% alkylate, and 12% aromatics. They see a decrease in the straightrun content of jet fuel from 72.7% in 1957 to 50% in 1962 because of the trend toward heavier jet fuels.

. . . **Refinery processing.** Catalytic cracking and catalytic polymerization should increase slightly. Visbreaking and coking, two processes which affect pool gasoline quality only slightly, also should have small gains. Most significant development will be the increase in alkylation capacity.

. . . **Refining techniques.** Wolf and Cole believe octane increases for gasoline pools from 1959 to 1962 will be accomplished primarily by these techniques:

Increasing catalytic reforming severity to an 80% level.

Catalytic reforming of heavy (200°-400°F) thermal naphtha at 80% severity.

Aromatic extraction of catalytic reformate (straightrun charge) and reform raffinate.

Maximum alkylation—alkylation of available isobutane, and polymerization of only the excess olefins.

Isomerization—recycling C_5, once through C_6.

Conclusions . . . Wolf and Cole do not draw hard and fast conclusions. There are too many variables.

However, they anticipate that runs this year will parallel closely the 1957 level. Thereafter, runs should increase annually about 3%. And these increases alone could affect quality.

The Ethyl representatives figure refinery runs of 85% of capacity as standard. However, if runs are reduced to 80% of capacity, the octane potential of the national pool would increase by .1 octane. Likewise, if runs are increased to 95% of capacity, the potential would be reduced by .8 octane.

Wolf and Cole single out the East Coast for special treatment and conclude that this region will continue to hold the lead in the octane race. While the annual increase for the octane pool will be around .4 octane, it will be about .5 octane for the East Coast.

PROCESSING

Two labor unions have the Wood River, Ill., refinery of Standard Oil Co. (Ind.) between a rock and a hard place. Company officials said both unions have threatened to strike—one if 17 employes aren't laid off, and one if they are.

AFL-CIO boilermakers local 483, expected to be certified as the new bargaining agent for a boilermaker group at the refinery, wants the 17 employes doing nonboilermaker work retained on their jobs. Central States Petroleum Union local 115 insists they should be laid off and replaced with nonboilermakers.

A diminishing Pennsylvania Grade crude oil supply and "other economic factors" is forcing a shutdown of Sinclair Refining Co.'s 10,000-bbl. refinery at Wellsville, N. Y. A company spokesman said a recent fire that seriously damaged one of the main processing units prevents the supplementing of the crude supply with crudes from other sources.

Hanlon Award Goes to Gard

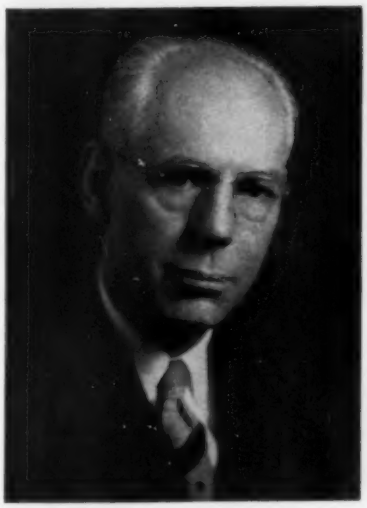
THE HIGHEST HONOR in the natural-gasoline industry and one of the highest awards in the petroleum industry was conferred last week on Clare D. Gard, Pasadena, formerly chief process engineer for Union Oil Co. of California.

Gard is the twenty-second recipient of the Hanlon Award, made each year by the Natural Gasoline Association of America. Presentation was made at the association's thirty-seventh annual convention in Dallas by the president of the NGAA, George T. Tennison, Shell Oil Co., Houston.

Gard retired last year after 37 years with Union. His first assignment in 1921 concerned experiments with different types of trays for use in gasoline-plant absorbers. As a result of his work, the perforated tray was adopted by Union and became the standard for the industry.

He played a leading role in such projects as the use of water draw-off trays in fractionating sections of fractionating stills and continuous side-stream reconditioning of absorption oil.

He also conceived and perfected equipment and procedure for calibrating natural-gasoline positive displacement meters under actual operating conditions, and stimulated gas-lift operations in California, planning and supervising work which resulted in substitution of compressed high-pressure wet gas for the dry gas then being used.



Clare D. Gard

. . . constructive force in the industry.

Here are some of the things he helped design or develop:

. . . **First LPG plant** in California.

. . . **First natural-gasoline plant** to produce dry ice as a byproduct of natural hydrocarbon gas.

. . . **First large-scale plant** to effect condensate recovery by means of expansion of gas produced at high wellhead pressures and regenerative cooling.

. . . **The Reid vapor pressure-composition** correlation which is used in California as the basis of evaluating the worth of natural gasoline.

Gard, a native of New Burlington, Ohio, obtained an electrical engineering education at the University of California, and then spent 2 years in service during World War I.

Donor of the award is E. I. Hanlon, chairman of the board of National Bank of Tulsa.

Products Line Cuts Rates

TEXAS EASTERN Transmission Corp. has made two moves to boost business for the Little Big Inch line which it has reconverted to products service.

The company last week cut its tariff 10, 20 and 30% where shippers schedule movements 60, 90, or 120 days in advance. The reduction applies to shipments from the Gulf Coast, Arkansas-Louisiana-Texas area, and southern Oklahoma into the Midwest.

The temporary rates, effective May 5, will continue the rest of 1958.

Texas Eastern also is moving its products-division headquarters from Shreveport to Houston, the origin of much of its business.

BRIEFS . . .

Fire set off by a series of explosions caused an estimated $100,000 damage last week at the Ben Franklin Oil Co., refinery near Ardmore, Okla. No one was injured. Four minor blasts followed an initial explosion of a tank containing propane. Officials said the explosion resulted from a leak in a 3-in. line while railroad tank cars were being loaded.

Four papers on methods of reducing evaporation losses will be presented at the spring meeting in Houston, Tex., next month of the evaporation loss committee of the American Petroleum Institute. Floor discussions also will be permitted at the all-day meeting May 6 in the Rice Hotel.

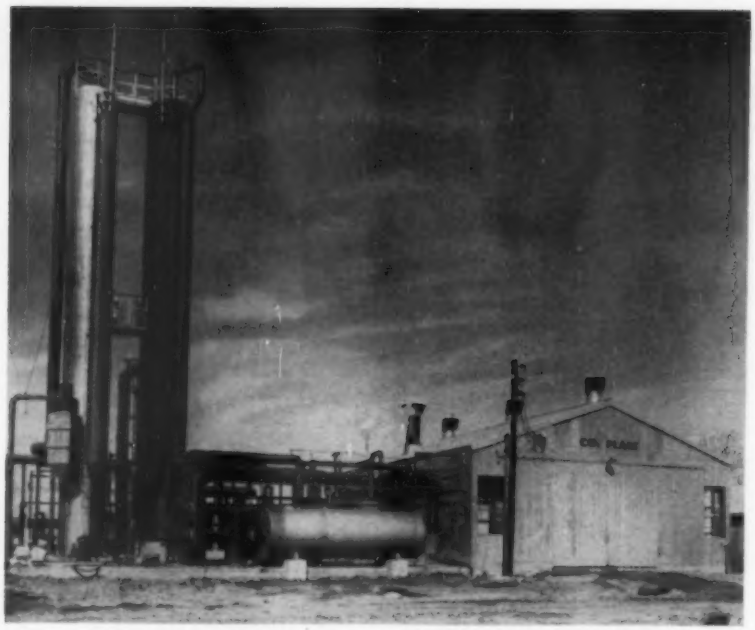
Socony Mobil Oil Co., Inc., has developed a new diesel-cylinder oil which reduces the high rate of cylinder-liner wear and other maintenance in motor ships using heavy boiler fuels. The new product, to be marketed as Mobilgard 593, does not require increased lubrication feed rate, nor does it require special handling or precautions aboard ship. Socony has carried out extensive tests of the new product under actual operating conditions.

A new natural-gasoline plant, with capacity of 25,000 M.c.f. daily, will be built in Tensas Parish, Louisiana, by N. H. Wheless Oil Co. and the W. C. Feazel interests. The plant will process gas purchased by Tensas Gas Gathering Corp. in Rodney field, Jefferson County, Mississippi. Tensas plans a 12-mile pipeline from the field across the Mississippi River to the proposed plant.

Also for Refiners . . .

IN THE NEWS: Crude and fuel-oil prices have been slashed in California in a move to solve the oversupply situation (p. 94) . . . At the ACS meeting in San Francisco, reports were given on Ethyl's new manganese antiknock additive, the need for better yardstick in evaluating asphalt, the demand for high-purity propylene by today's petrochemicals manufacturers, and how motorists are getting better mileage with high octanes and higher compression ratios (pp. 96-97) . . . Ethyl researchers tell NPA the annual octane increase will be 0.4 (p. 102) . . . Hanlon Award goes to Clare D. Gard (p. 103) . . . Romania will help Indian Government build 20,000-bbl. refinery in Assam (p. 110).

PLUS THESE TECHNICAL REPORTS: Chromatography forum (pp. 114-129) . . . Annual survey of field-processing plants (p. 130) . . . Refinery lighting requires new data (p. 169) . . . Process Costimating (p. 177).



NEW CARBON DIOXIDE plant may lead to three oil crops as . . .

Orco Launches Unusual Flood

STRIPPER-WELL operators, eager for a second or even a third crop of oil from the same reservoir, are closely watching a unique flood in northeastern Oklahoma.

The project is Oil Recovery Corp.'s carbonated-water flood near Bartlesville—the first full-scale carbon dioxide flood in the nation.

Last week, Orco began injecting 600,000 cu. ft. of carbon dioxide daily into the Bartlesville sand, underlying a 240-acre stripper lease near the center of the sprawling Bartlesville-Dewey field.

If it works, it could mean a new process for tertiary as well as secondary recovery in old fields, where sometimes more than half the oil remains in the ground even after water flooding.

The company thinks its Orco process has big possibilities along two lines:

. . . **In secondary recovery.** Orco engineers are confident that carbonated water can coax up twice as much oil as the average flood in that area.

. . . **As a tertiary-recovery tool.** An operator whose lease has already been water flooded could apply carbon dioxide to recover additional oil equal to 75% of the water-flood recovery.

This would be possible, Orco says, because of the carbonated water's ability to sweep a wide area and to displace a high percentage of the oil in place (OGJ, Sept. 9, 1957, p. 88).

New plant . . . Orco has spent more than $350,000 for distribution facilities and a recently completed plant which manufactures carbon dioxide from natural gas.

This is the company's first commercial application of the Orco process, after years of lab work and pilot projects. But it will be some months yet before results are known. The first production increase is not expected until early next fall.

If the project succeeds, Orco will be set up to distribute carbon dioxide to other projects in the area. The new plant about 8 miles north of Bartlesville is located near the center of the field and is literally ringed by ordinary water-flood projects and played-out leases. Carbon dioxide could be piped from the plant to projects within a radius of 20 miles.

An estimated one-half to two-thirds of the injected dioxide is expected to be recovered and will be reinjected. The natural gas from which the CO_2 is manufactured comes from a nearby Cities Service pipeline.

The pattern . . . Wellsville Oil Co., Wellsville, N. Y., which owns 20% of the lease, is operator of the project and has already drilled 23 injection wells. Another 12 will eventually be drilled.

The pattern calls for an injection well at each corner of a 10-acre tract, with a producer in the center. This will involve 24 producing wells, 11 of which have already been drilled.

The company has been building up pressure in the formation through water injection the past month. Injection rate averages about 200 bbl. daily per well. Contact point for the carbon dioxide and the injected water is at the bottom of the injection well, where pressure of 800 psi. must be maintained.

What it does . . . Orco engineers say the process is economical and has a number of beneficial results. The carbon dioxide will:

. . . **Act as a wetting agent** throughout the entire sand body. The CO_2 forms surface-active agents in the formation that help sweep more oil and gas from sand surfaces. These agents are formed by reaction of the carbonated water with the hydrocarbons and the minerals in the sand.

. . . **Build up a miscible-phase effect.** Orco pilot floods showed a big increase in gas production—10 times greater than what an ordinary water flood produces. And the gas is surprisingly rich. This results in a wave of lighter hydrocarbons moving ahead of the flood front of carbonated water. Orco engineers say the front "is under full flooding pressure and will act as would any miscible-phase flood."

They also point out that this advantage of the miscible-phase effect with carbonated water does not require the cost of buying and compressing the rich natural gas.

. . . **Increase water-injection rate.** Orco's earlier tests showed that in sands of low permeability, a much greater volume of carbonated water could be injected into a well under the same pressure.

This is already showing up at the Bartlesville project. Injection wells which wouldn't take as much as 10 bbl. of water per day were taking more than 250 bbl. daily after injection of carbonated water. Such readiness to invade tight sands has the marked advantage of increased flood efficiency.

The Bartlesville sand on the Orco lease is found at about 1,300 ft. Most of the oil in the Bartlesville-Dewey area is from this formation. The area was first developed in the 1920's and extends about 15 miles north and south and 8 miles east and west.

Orco engineers estimate that probably about half the area has already been flooded, although more than half the original oil in place still remains in the ground. They are confident that CO_2 will make possible a third take from the old field.

Import Plan Enforced

. . . by military agency. Bidders for new contracts must agree to stay within quotas. More bids to be opened.

THE MILITARY Petroleum Supply Agency has taken steps to enforce President Eisenhower's voluntary import program.

The MPSA notified all prospective bidders for government oil contracts that they will be required to certify compliance with the program "in all respects" during the period of any contract.

Certificates of past compliance, also required by the President's order, have not yet begun to issue from Capt. M. V. Carson, Jr., program administrator.

Past compliance will not be a factor in new contracts which the MPSA will award on the basis of bids opened last week and to be opened this week, according to an Interior Department spokesman.

The executive order requires that bidders must have been in compliance with the program for the 3 months prior to that in which bids are tendered.

That order does not go into effect until after the end of this week. It has been interpreted as not applying to the current bids.

The requirement that contractors agree to stay within their import quotas during the life of a contract will be applied, however, since it will not be possible for the MPSA to make awards before the executive order goes into effect.

In the case of all bids opened after this week both ends of the order will be effective.

Any importer offering avgas made, in whole or in part, from foreign crude will have to furnish certificates of past and future compliance. Such certificates will not be necessary if their product is made from domestic crude only, however.

Ikard plan discussed . . . Officials of a number of independent oil associations met in Washington last week to discuss their strategy in support of the Ikard bill putting oil quotas into the Reciprocal Trade Act.

The issue will be discussed at length April 28 at the midyear meeting of the Independent Petroleum Association of America in Chicago. Both Rep. Frank Ikard (D-Tex.) and Sen. Robert S. Kerr (D-Okla.) will address the meeting.

Ikard is a member of the House ways and means committee, which is now getting down to a study of his bill and other proposals for control of oil imports. Kerr is a member of the Senate finance committee, which will handle the issue in the upper chamber.

Gas is different . . . There is no inconsistency in domestic producers supporting mandatory controls while opposing federal regulation of natural gas production, Russell B. Brown, IPAA general counsel, declared last week.

The natural gas question "is the extension of federal controls over the price of a local competitively produced commodity," Brown explained. It is an action "which is without precedent in the peacetime history of our country," he said.

But Congress has always regulated foreign trade, he pointed out. It is, in fact, the only agency empowered by the Constitution to deal with import problems such as now confront the oil industry.

Mission Adapts a Valve for Unitree

SPACE-SAVING VALVES play a key role in the new compact, lightweight, money-saving "unitree," just introduced to the industry (OGJ, April 7, p. 104).

The valves have been tested at more than 30,000 psi. and are rated for 15,000 psi. working pressure.

In the picture above, a valve is held by Robert L. Ohls, research engineer for Mission Manufacturing Co., which developed it for Oil Center Tool Co., Houston.

The outside surface of the valve is tapered and fits the body of the tree with zero clearance. The flow-way has resilient, pressure-operated seals, and the lock ring (right) holds the valve in place.

While the outside is tapered, the core of the valve is a straight-cylindrical type. Mission claims that its balanced - stem and self - lubricating design prevents it from sticking, wedging, or leaking.

Actually, Mission developed the valve for use in high-pressure drill-stem-test heads. When Oil Center Tool developed its unitree, Mission adapted the outside of the valve for the new application.

Mission sees other applications for the valve, including use in space-saving production manifolds.

Citronelle Evaluated

. . . by Core Lab. Conclusion: Primary recovery will be low; flooding would help, if study shows it economical.

IF CITRONELLE field is flooded by the time pressure drops to the bubble point, total recovery will reach about 64,000,000 bbl.

But it isn't known yet whether it will be economical to flood the big Alabama field.

That's the essence of a preliminary report made to the Citronelle operators' committee by Core Laboratories, Inc., Dallas, which is serving as a consultant.

Core Lab figures that primary recovery will be only 14,000,000 bbl. by the time pressure falls to the bubble point—at about 500 psi. A water flood begun then would recover another 50,000,000 bbl.

Of course, if Citronelle operators were unable or unwilling to launch a flood prior to that time, primary production would continue past the bubble-point pressure level.

The 14,000,000-bbl. figure stacks up with a total of 300,000,000 bbl. of oil which Core Lab estimates as originally in place in upper and lower Donovan zones of the Rodessa.

This would figure out to a primary take to the bubble point of only about 4.66% of oil in place—and to a total take with water flooding of about 21.3%.

Figures vary . . . The Core Lab estimate of oil in place is much higher than some operators had believed.

Other estimates have been in the neighborhood of 150,000,000 bbl. But it is pointed out that Core Lab includes oil content of all oil-bearing Rodessa sands over the entire Citronelle structure. More than 40% of the structure is undeveloped in thinning-sand areas where operators doubt that production would prove economic.

Too, Core Lab identifies 40 separate sands in the upper and lower Donovan members of the Rodessa. And the 300,000,000 bbl. estimate includes the oil in some cases of sands which may not be now contributing to production.

The consensus of operators has been that the field likely would produce half again as much oil below the bubble point as it produced before pressure fell to that point if no flood were launched.

Core Lab is studying this question, too, and will advise operators of its findings in a later report.

Also in this later report will be:

. . . A study of the economics of a Citronelle flood. The preliminary report deals only with the physical possibility of a flood and how it would affect recovery.

. . . A look at other methods of increasing recovery—namely, gas injection and a miscible phase program—and how they would compare with flooding on recovery and cost.

Pressure plunging . . . It likely will be 6 weeks or more before the exhaustive final analysis of the feasibility of applying the various artificial drives can be turned over to the operators.

Meanwhile, Rodessa pressure continues to plunge at a rate of around 5 psi. daily. And some operators predict that pressure will fall below the bubble point early this fall. There is nothing to indicate the rate might slacken (OGJ, March 3, p. 73).

Citronelle operators generally think it impossible to get the field unitized and some form of artificial drive launched prior to this. Some think mid-1959 would be the earliest it could be achieved.

Going below the bubble point at Citronelle, operators believe, shouldn't have much effect on the volume of oil that could be recovered by flooding. But it likely will result in increasing lifting costs that already are beginning to get painful in many cases.

Citronelle had produced about 6,715,000 bbl. of oil to the first of March—about half what Core Lab predicts for it to the bubble-point pressure level.

Test Abandoned

in Washington after second try. Well was expensive.

A SECOND EFFORT to find oil in the same wildcat in Benton County, Washington, has failed.

Standard Oil Co. of California, Western Operations, Inc., has abandoned its 1 Rattlesnake Hills at 10,655 ft.

Originally, Standard-Western drilled the wildcat to 8,400 ft., most of it through volcanic basalt, and then suspended operations in December. At that time, the company announced it had spent $625,000 on the test and was able to average only 46 ft. per day during 182 days of drilling.

When Standard-Western resumed drilling in February, it tried several innovations, without success, to increase penetration rates through the

PIPELINE BRIEFS . . .

Cities Service Gas Co. is suing Skelly Oil Co. for $777,853 in alleged overpayment under a natural-gas contract as a result of a U. S. Supreme Court ruling knocking out the Oklahoma minimum-price regulation. Cities Service seeks to recover the difference between its contract price of 4 cents per M.c.f. and the 9.8262-cent minimum set by the Oklahoma Corporation Commission in 1952.

Cities Service and other gas companies similarly affected lost appeals in Oklahoma courts but won their case before the U. S. Supreme Court in January. Large sums are at stake in the refund issue which Cities Service is trying to settle in Delaware Superior Court.

Tennessee Gas Transmission Co. reports its planned 1958 expansion has been reduced 40% as a result of the Memphis decision requiring advance customer approval of new rates. TGT has FPC authorization to build $128-million in new facilities this year. One holdout customer is reported tying up a major project.

Magnolia Petroleum Co. will let contracts this month on a 22-mile, 16-in. offshore crude line. The line will transport crude produced in the West Cameron area off Louisiana.

Phillips Petroleum Co. plans to lay 88 miles of gas line in Texas and New Mexico. Phillips has contracted 11 miles of 3 to 20-in. in Hutchinson County, Texas, to H. A. McGinnis, to be completed this year. Other projects are 25 miles of 6 to 20-in. in the South Eunice, New Mexico, area, and 52 miles of 4 to 20-in. in Gaines County, Texas. Phillips plans a 44-mile, 6-in. products line from its Rocky pump station to Amarillo, Tex.

Consumer Power Co. and its affiliate, Michigan Gas Storage Co., will build 85 miles of gas-transmission lines this year and 45 miles next year.

basalt. These included the first extensive use of air drilling in the state.

The wildcat is located in a 100,000-acre block 20 miles north of Prosser in eastern Washington.

It ranks as the second deepest test drilled in the state. The record holder is Standard-Western's 11,002-ft. wildcat, in Snohomish County, abandoned in 1947.

The only active test under way in Washington is the 1 Sylvester Gunther, now drilling below 4,339 ft., 10 miles southeast of Chehalis. Pleasant Valley Gas & Oil Co., and others, are drilling the well to an 8,000-ft. objective on a farmout from Continental Oil Co.

Small Refineries Defined

SMALL REFINERIES will be given wider opportunities to share in government contracts.

A new definition of what a small refiner is has been issued by Wendell B. Barnes, small business administrator.

The ruling classes as small business for the purpose of government procurement any refining concern that (1) is independently owned and operated, (2) is not dominant in its field of operation, (3) does not have more than 30,000-bbl.-per-day capacity from owned or leased facilities, and (4) employs not more than 1,000 persons, affiliates included.

Tax Benefits for Coal, Shale

. . . asked by Seaton to speed synthetic-fuels research; oil value should determine depletion allowance, he believes.

THE EISENHOWER administration last week came out in support of a 27½% depletion allowance for synthetic liquid fuel materials.

A depletion allowance matching that for petroleum would speed private research on synthetic fuels, Interior Sec. Fred A. Seaton said in a report to the Senate finance committee.

Bills providing for the higher allowance have been filed in Congress by Sen. Gordon Allott (R.) and Rep. Wayne N. Aspinall (D.), both of Colorado. The present depletion is 15% for oil shale and 10% for coal.

The allowance should be based on the value of the oil derived from shale or coal, rather than upon the value of the raw material, Seaton said. In the case of shale this would be kerogen, an unrefined liquid from which gasoline, diesel fuel, and other products can be made.

"It is entirely likely that in the not too distant future this nation will depend, in part, upon the production and use of synthetic liquid fuels, in view of the continuing trend to increased mechanization of our military establishment and of the expanding economy, with their growing dependency on liquid fuels," Seaton said.

Unless new sources of domestic liquid fuels are developed, our dependence on foreign oil will continue to increase, he warned.

Huge reserves . . . Seaton pointed out that a large portion of our oil-shale reserves is on public lands. The Government would receive "substantial" sums in royalties and lease revenue if synthetic fuels are developed, he said.

The reserves in Colorado's Piceance Creek basin alone are estimated to have oil content of 959 billion barrels, about 26 times the estimated known oil reserves, Seaton said.

"The research and experimentation which will be needed before a shale-oil industry can be established will require the expenditure of substantial sums of money," he told the committee.

"The capital outlays for the establishment of a new industry will not be readily forthcoming unless this potential industry is in a comparable competitive position with the existing petroleum industry."

The 1958 program, given temporary approval by the Federal Power Commission, includes 40 miles of 26-in. from Ithaca to Stevenson Lake junction to loop Michigan Gas main lines to storage fields.

Consumers will build 45 miles of 24-in. from Overisel gas field to Woodbury station. The line will be extended 45 miles to Laingsburg Junction on Michigan Gas' main line next year. Consumers Power, Michigan Gas' sole customer, has 1958-59 peak-day requirements estimated at 523,500 M.c.f., most of which will be supplied from storage.

Portland Pipe Line Corp. and Montreal Pipe Line Co., Ltd., have suspended plans for laying 50 miles of 24-in. loops along a dual 12 and 18-in. system from Portland, Me., to Montreal. The contract had been let to Oklahoma Pipe Line Constructors, Dallas. With the reduced demand, the system was adequate to meet immediate needs without the expansion, which would have raised capacity 15,000 bbl. to 267,000 bbl. per day.

Service Pipe Line Co. has awarded a contract to build 76 miles of 20-in. loops on its Wyoming crude system to O. R. Burden Construction Corp., Tulsa. The looping is in two sections, 41.3 miles from Fort Laramie, Wyo., to Glendo Junction, and 34.6 miles from Welch to a connection with the existing system at Casper. The project, which replaces segments of Service's 12-in. line, will start May 1 and will be completed early in the fall.

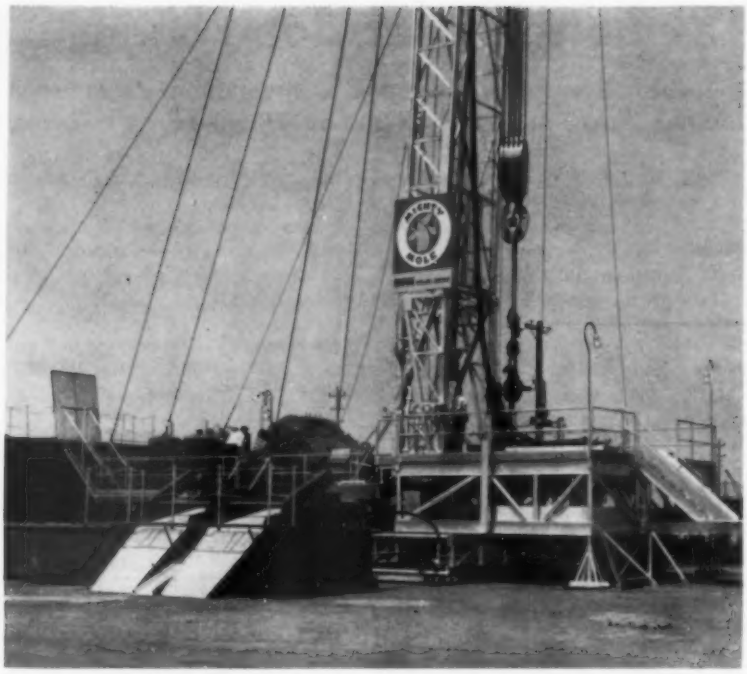
Van Tor Oils & Exploration Co., Vancouver, is negotiating with Westcoast Transmission Co., Ltd., for gas to supply a proposed line from the British Columbia mainland to Vancouver Island within the next 2 years. Van Tor owns 98 per cent of Vancouver Island Natural Gas Co., Ltd. The proposed project, to cost $2,500,000 to $3,000,000, would be underwritten by two financial houses in Great Britain.

Final link of the 750-mile Four Corners pipeline was installed last week. Initial deliveries of crude will arrive in Los Angeles early this week Initial throughput will be approximately 70,000 bbl. daily.

Also for Pipeliners . . .

IN THE NEWS: An FPC examiner has approved a record price of 23.9 cents for South Louisiana gas, to be handled by Texas Eastern Transmission Corp. (p. 92) . . . The IPAA will meet in Chicago next week to continue its fight to end FPC regulation (p. 93) . . . Transwestern Pipeline Co. has asked the FPC to approve a $193-million 1,305-mile system that will tap the lucrative California gas market (p. 100) . . . The projected Sahara pipeline will help bring results from France's big investment in oil exploration (p. 111).

PLUS THESE TECHNICAL REPORTS: Pipeline analyzer outlines gas-gathering systems (p. 160) . . . On the job in pipelining (p. 179).



THIS is the "Mighty Mole," just unveiled in California. It's a . . .

New Mobile Rig Ready to Go

A TRAILER-MOUNTED rig designed to meet the low prices contractors are getting in California fields will be placed in operation this month by Brown Drilling Co.

The rig is a money-saver because it makes possible faster moving, rigging, and digging. California drilling contractors have been hard-pressed recently by heavy competition and a dropoff in drilling. With more than half the rigs down in the state, the contractors are looking for ways to cut costs.

The new rig, dubbed the "Mighty Mole," is designed to do just that.

Specializing on wells in the 4,000 to 9,000-ft. range, the rig has 1,500 hp. well distributed so that it will speed drilling. Its more novel features, however, make for rapid rigging up and moving.

Here is what the developers claim for the new rig:

. . . **Maximum mobility.** The three main drilling items are trailer-mounted. These are the 126-ft. telescoping mast, the draw works and its two engines and compound, and a combination mud-water-fuel tank. The entire rig, with 8,000 ft. of drill tubing, can move over highways in 13 loads.

. . . **Rapid rig-up.** By using the big combination tank as an anchor, no guy wires to deadmen are required. Mud, water, power, and fuel lines are unitized into the various pieces of equipment so that little time is lost making connections. Two men can connect all lines within 45 minutes after the packages have been spotted.

. . . **Weight reduction.** Aluminum is used for stairs and hand-rails. Two men easily can move the stairs into position. No crane is needed.

Power supply for the "Mighty Mole" consists of five 350-hp. diesels, equipped with turbochargers and hydraulic dumping converters. Two of the diesels supply the draw works, two are skid-mounted with the main mud pump, and the fifth is skid-mounted with the auxiliary pump.

Little time will be required for separating the draw works and mast trailers. By breaking out one connection in the rotary-table drive, the two trailers can be moved out without further disassembly.

A. J. Heiser, vice president of Brown Drilling, had this to say when the rig was unveiled at Bakersfield:

"Because trucks and cranes are an important and ever-increasing part of every contractor's costs, we feel that we will be offering the industry quite an economy feature by being able to get onto a job with less expense and carry on the job with the most efficient and cost-free equipment available."

—— Industry briefs

Producing Properties, Inc., Dallas, last week paid roughly $450,000 in two separate deals for producing properties in the SACROC Unit in Scurry County, Texas, and KMA field in North Texas. The SACROC leases, assembled and handled through William Sherry, Tulsa, were purchased for $250,000. Producing Properties paid about $200,000 to H. D. Egger, Dallas, for the KMA leases. The company estimates that it acquired net reserves of about 600,000 bbl. in the two transactions.

Steelman Gas, Ltd., will spend about $500,000 this year for development of underground storage for LPG in southeastern Saskatchewan. The storage will be developed in conjunction with the company's natural-gasoline plant at Steelman field. LPG will be stored in salt layers either at Melville or Yorkton, about 120 miles north of Steelman field. Initial capacity will be 200,000 bbl., with ultimate capacity of 400,000 bbl. The new plant, which will process about 25,000 M.c.f. of gas daily, is scheduled for completion in September.

The Navajo Indians may offer additional tribal lands for oil and gas leasing in the late fall. Paul Jones, chairman of the Navajo Tribal Council at Window Rock, Ariz., said the council is considering such a move, and that a number of requests for advertising certain tracts already are on file.

Cities Service Oil Co. has purchased the Stonewall gasoline plant in Stonewall County, Texas, from Liquigas Co., Dallas. The plant, currently producing 75,000 gal. daily of natural-gas liquids, is supplied by a gathering system which extends 30 miles from the plant and handles 15 million cubic feet of gas daily from 12 small oil fields.

The Navy will need less oil during the 1959 fiscal year than it is using now or used in fiscal 1957.

Present schedules of fleet movements call for 30.4 million barrels of Navy special fuel during the 12 months beginning July 1. This compares with 31.2 million barrels during the current fiscal year and 32.86 million in fiscal 1957.

Navy officials told a House appropriations subcommittee that diesel-fuel requirements for fiscal 1959 will be 3.13 million barrels, against 3.17 this year and 3.14 in 1957.

Puerto Rico Draws Exploration

PUERTO RICO'S plan to lure oil hunters by offering a more attractive oil law has found takers.

In the 5 months since the law was revised, the government has granted three concessions that cover large chunks of what geologists think are the best prospective areas. These are the northern and southern coastal basins.

The latest award went to Maritime Oil Co., headed by David L. Gordon, a Houston independent. The concession covers more than 200,000 acres of onshore and offshore rights along the island's southern coast. It is adjacent to a larger concession held by Esteban Vidal, a private Puerto Rican resident, located at Ponce (see map).

Allas Tair Frazer, an individual with copper and iron mining interests in Jamaica, obtained the first concession. His acreage includes onshore and offshore areas over more than half the north shore of the island.

Frazer has already started preliminary work. Aero Service, Ottawa, is making an airborne magnetometer and scintillometer survey of his area. Geophysical Engineering & Survey, Ltd., Toronto, is under contract for ground work.

The three concessions cover areas which have the most likely prospects. More than 6,000 ft. of fossiliferous pyroclastic sediments have been mapped in the northwestern part of the island. Mixed sediments and volcanics from 14,000 to 18,000 ft. thick lie in the southeastern part of the island.

Under the revised law, the exclusive prospecting permits are renewable for 10 years, with an option to select 49,400 acres for drilling leases each year from the permit area. Leases can extend up to 70 years, including an initial 40-year period plus renewal options.

In case commercial production is developed, royalties will be paid to the government on a sliding scale, ranging from 5 to 16⅔%. Crude may be either exported freely, or marketed in Puerto Rico (OGJ, Jan. 13, p. 72).

Expansion Planned

for Pakistan's natural-gas pipeline. New plants due.

PAKISTAN'S NATURAL-gas industry is due to expand further with an extension of the Sui-Multan pipeline and two fertilizer plant projects.

Sui Gas Transmission Co. plans to extend the 16-in. line, which runs northeast from Sui, another 130 miles to Lyallpur. It is now completing the 310-mile section to Multan. Lyallpur is a cotton-weaving center. The line will furnish fuel for central power plants which will replace the small, fuel-oil burning generators operating at individual mills.

One of the fertilizing plants will be located at Multan. The other will be located more than 1,000 miles eastward near Sylhet gas field in East Pakistan. Both plants will produce about 250,000 tons of urea per year.

The East Pakistan plant will be built at Jenchuganj, 12 miles south of the Pakistan Petroleum Co. discovery. The project got the nod over an earlier proposal to build a 145-mile, 8-in. high-pressure line to Dacca, the capital of the east wing. A Japanese company, Kobe Steel, will build the plant.

Subsidiaries of Burmah Oil Co. made the Sui and Sylhet discoveries while searching for oil. The latest test in East Pakistan, Lalmai 1, has been abandoned slightly short of 10,000 ft. The test had circulation troubles and a difficult fishing job.

Japan Pays Bonus

for Neutral Zone offshore concession after time lag.

AFTER DRAGGING its feet 4 months, the Japanese Government last week approved the payment of $1,500,000 to Saudi Arabia to sew up its concession to the Saudi half of the offshore Neutral Zone concession.

The Japanese Ministry of Finance last week bowed to the backers of the Japanese concession deal. The ministry had been holding out on its guarantee of payment of the initial bonus because it was afraid the Japanese wouldn't succeed in getting the Kuwait half of the concession. This is still very much in doubt.

The argument which apparently swayed the finance ministry was that the Saudi Arabian Government would cancel the deal unless the money was paid. The concession agreement called for the payment of the $1.5 million as soon as the agreement became effective. It was signed in December and published in Saudi Arabia in January.

The Japanese also feel that the Saudis may help them in their negotiations with the Shaikh of Kuwait once the initial annual bonus is paid.

Reds Seeking Syrian Oil?

THE PRESENCE of Russian oil technicians in Syria may mean the country has taken up the Soviet offer to finance an oil exploration program.

The Russians may set up shop in northeastern Syria, where Concordia, a German-owned company, and an American group composed of J. W. MenHall, Atlantic Refining, and Plymouth Steel are drilling on separate concession areas.

Work by the Russians would include surveys and 18 wildcats of 5,000 to 10,000 ft. Syria would pay for the program over a 12-year period at 2½% interest (OGJ, Jan. 27, p. 58).

U. S. Firms Go Abroad

. . . at high clip in search of foreign oil. Survey cites one reason as hard-to-find, costly domestic production.

AMERICAN COMPANIES are moving abroad at an "astonishing" rate to keep up with the shifting center of gravity in the world's oil industry.

This is the key point of a study of American firms in foreign areas by Leonard M. Fanning, well-known oil author.

Gulf Oil Corp. says it regards the facts in the survey to be so important it will sponsor distribution of the report throughout the country.

Fanning made an exhaustive count of domestic firms that have made the leap into foreign areas. His findings:

. . . **The oil industry** is already largely international. There are 190 companies with a foreign stake, compared with 28 after World War II. A total of 122 firms engaging in domestic exploration or production have foreign interests.

. . . **The move** is across - the - board. Active abroad are 74 good-sized, publicly-owned corporations, 100 small companies with either a few stockholders or closed family control, and 16 partnerships and individuals.

. . . **Smaller companies** have 478 foreign operations in 70 countries. These are firms other than the so-called big five internationals, Gulf Oil, Jersey Standard, Socony Mobil, California Standard, and The Texas Co.

Why they go . . . As Fanning sees it, domestic producers who have started looking for oil abroad in the last 10 years had sound reasons for doing so.

He cites hard-to-find and costly domestic production, the shift of the "center of gravity" of reserves to foreign countries, and the desire to participate and profit in the expanding and great potential foreign markets.

American ownership in foreign reserves has increased from 35 to 57% in the past 20 years. In the same period, U. S. reserves have slipped from 59 to 14% of the free-world total. The author says that if American companies had not invested in foreign development, the position of the country in relation to production and reserves would be bleak.

Fanning points out as other signs of the shifting center of gravity in the past 20 years, a U. S. slip from 72 to 52% in total free-world refining capacity. U. S. crude output has fallen from 68 to 47%, and consumption from 68 to 54%.

Plant Work Halted

in Ecuador in protest over low, government-set prices.

ANGLO-ECUADORIAN Oilfields is suspending work on its new 7,700-bbl. refinery at La Libertad in a showdown with the Ecuadorian Government over low products prices.

The company was building the plant under the terms of a 4-year-old agreement with the government. The $4,200,000 project includes a 6,000-bbl. thermal cracking unit. It is supposed to replace a 31-year-old, 5,000-bbl. refinery now located at La Libertad.

In return for the refinery building program, the government granted Anglo-Ecuadorian a 30-year refining concession along with exclusive marketing rights. The hitch for the company is that the government controls prices. Under the country's oil law, the government is supposed to review products prices yearly, fixing them at a point which allows a fair profit.

But the company for years has complained it loses money on its marketing operations. Heavy losses are taken especially on gasoline, much of which must be imported. The price of gasoline has not gone up since 1949, and prices of most other products haven't increased since 1955.

In the past, marketing losses were offset by the export of surplus crude. If the new refinery opens this year, however, there will be no surplus crude on which to make a profit.

Other moves by the company include reducing the scale of its present operations and curtailing capital expenditures. It accounts for about 90% of the country's 9,300 bbl. daily crude production, directly and through two small subsidiaries, Carolina Oil Co. and Petropolis Oil Co.

Crude Unit Is Enlarged

THE BIG CRUDE stabilization unit of Arabian American Oil Co. at Abqaiq has been expanded to handle up to 950,000 bbl. daily.

The former four-column unit removed hydrogen-sulfide gases from 560,000 bbl. daily in winter, and 660,000 bbl. daily in summer. Aramco increased the capacity to 870,000 bbl. in winter, and 950,000 bbl. in hot weather by expanding the stabilizer to five columns and adding an external disengaging drum to one of them.

The disengaging drum helps even out the difference in capacity in hot and cold weather. Higher than normal water content in crude lowers the capacity in winter. This is due to excessive foaming in the columns. The drum is a vessel laid on its side and attached to a column to draw off some of the foam.

Assam Plant Due

by late 1960. India to get technical aid from Romania.

THE INDIAN Government hopes to have a 20,000-bbl. refinery on stream in Assam by the end of 1960 with the aid of Romanian financial and technical help.

The refinery is the first of two plants to be built in northeastern India to take advantage of shut-in crude production in the Nahorkatiya area. Present plans are to build the refinery near Gauhati, in Central Assam.

An early agreement on the plan was reached during the recent visit of the Romanian prime minister.

The government will be sole owner of the new refineries. The second plant will be located at Barauni, in Bihar state.

Crude production in the Nahorkatiya-Moran licenses and transportation will be handled by a newly formed company, Oil India, Ltd.

The Indian Government will have one-third interest. Burmah Oil Co. and its local subsidary, Assam Oil Co., will have two-thirds.

French Gas May Be Used

NATURAL GAS from Lacq field in southwestern France will be used in electrolytic aluminum and power plants if present proposals shape up.

Petrofigaz, a company formed to promote the use of gas in the Lacq vicinity, is trying to raise $72 million to finance its projects. The power and electrolysis plants would be built and operated by the Pechinet-Ugine group, which now handles all domestic production of aluminum.

Lacq currently produces about 35,300 M.c.f. daily. This will be raised to 706,000 M.c.f. daily by 1960, and possibly more later. Gaz de France, a part owner of Petrofigaz, plans to build a 550-mile, 24-in. pipeline to Paris (OGJ, Feb. 25, 1957, p. 98).

Shaikh, BP Chairman Dine, Talk Oil

THE LUNCHEON TOPIC of conversation on this occasion had to be oil.

Shaikh Shakhbut bin Sultan, ruler of the Trucial Coast kingdom of Abu Dhabi, was the host, and the guest of honor was Sir Neville Gass, chairman of British Petrolum Co., Ltd. The luncheon was held at the shaikh's palace after the BP chairman made a helicopter trip to the offshore platform, Adma Enterprise, in the Persian Gulf.

Sir Neville made his personal visit to the wildcat just about the time his company and its French partner, Cie. Francaise de Petroles, learned their $14-million investment may pay off. The companies have had a show of oil in their first test of the 12,000-sq. mile offshore concession granted by the Abu Dhabi ruler. No details are available, but the show is a bright spot in the Persian Gulf picture.

Spudded in January about 20 miles east of the little island of Das where the two companies maintain a base camp, Adma F-1 is drilling below 5,000 ft. trying to bring in the Persian Gulf's third oil field.

French Oil Gains Slow But Sure

THE MILLIONS of dollars poured into oil exploration in the French Union are slowly but surely beginning to show results.

The big jackpot of Algerian crude supplies still is years away. But the hard-pressed French are starting to wean themselves away from dependence on Middle East fields.

Out of every 100 bbl. of oil run to French stills last year, 6 hard-earned barrels came from France or French Africa. This was a small, but morale-building gain over a year earlier.

The French are almost certain to show another small gain in 1958. Year-old production in Gabon has risen to where it is now second in French territory behind Esso-Rep's Parentis field. Shipments from the French West Africa area averaged 6,900 bbl. daily the first quarter of the year, compared with 2,300 bbl. daily in 1957.

Token production from Hassi Messaoud field started at 2,400 bbl. daily this year, taken out by a small-diameter pipeline and by rail to Algeria's Mediterranean Coast.

Production from the field rose to 6,300 bbl. daily in March. Another tanker is being added to the run across the Mediterranean, from Philippeville to Lavera, France. This will enable a step-up in output to 8,500 bbl. daily.

These vest-pocket type gains are all adding to the upward curve the French count on to blossom into big production by world standards. If the political weather clears, Hassi Messaoud will be producing 100,000 bbl. daily to start, and 300,000 bbl. daily later when a large-diameter pipeline is built to the Mediterranean.

Development of fields in the Edjele area will further add to Sahara production.

Total runs to French stills last year averaged 498,000 bbl. daily, of which 74.7% came from the Middle East. In more nearly normal 1956, runs averaged 536,000 bbl. daily, of which 86.4% came from the Middle East.

In contrast, French and French Union production grew continually during the troubled period, rising from 27,000 bbl. daily before the crises to 41,000 bbl. daily at present.

Oil Rights Granted

Jersey Standard for large Portuguese Guinea acreage.

THE PORTUGUESE Government has granted an 11,000,000-acre concession in Portuguese Guinea to Standard Oil Co. (N.J.).

The concession covers both onshore and offshore rights in the West African colony. Jersey Standard has agreed to spend a minimum of $7 millions over a 5-year period for exploration and development. If a commercial discovery is found, the standard 50-50 profit split will go into effect.

A new affiliate, Esso Exploration Guine, Inc., was set up to handle the work. The headquarters of the company will be located in Portugal, and the majority of the board will be Portuguese.

Portuguese Guinea lies to the south of the coastal region of Senegal in French West Africa, where Ste. des Petroles du Senegal is starting a wildcat at Casamance. British Petroleum Co., Ltd., has half interest in the Senegal program.

Maracaibo Areas Get Names

TWO NEW LAKE Maracaibo producing areas are going to be called by name instead of by the block numbers they've had since the last concessions awards.

The old Block 10 will now be called Santa Maria since the group headed by Phillips Petroleum established it as productive. The discovery, LSG-0-1, tested 4,080 bbl. daily of 22.5° crude on a ¾-in. choke.

Signal Oil, which heads a four-company group developing Block 4, will call its new field Centro Lago. Signal has two good producers in the center of the lake block and last week had tested 5,136 bbl. daily from a 56-ft. section of the Eocene C-2 sand between 10,144-10,200 ft. The well is being drilled ahead to 12,500 ft.

Chinese Reds Excited

. . . over three prime discoveries 100 miles from Chunking. More than 3,000 experts being sent to the new oil area.

A MASS EXODUS of engineers, geologists, and drilling crews was under way last week as the Chinese Reds moved their oil people from the established oil area of Yumen to the scene of new discoveries in Szechwan province, 500 miles to the south and west.

Reports from Hong Hong indicate the Chinese are moving expert personnel to the new oil area in force—3,400 strong.

The reason for all the excitement, according to Chinese reports, is three prime discoveries made in South Central China within a 100 miles of Chunking, the principal city of that area. Three new wells have been shut in after flowing more than 400 bbl. an hour on tests. All three are in a region that has never before produced oil in commercial quantities.

First reports of the three news wells came almost 1 month ago in radio reports from the Peking capital of the Red Chinese Government. Radio reports said the three widely separate wells were drilled on three separate structures in 850-sq.-mile area within 100 miles of Chunking.

This region is at least 500 miles from any of China's only commercial oil fields, all located in Northwest China.

The Communist country's reserves are conceded to be tremendous, but the vast region produces less than 30,000 bbl. daily.

Discoveries important . . . If reports of new discoveries are factual, the Szechwan discoveries may prove to be far more valuable than the Northwest Fina fields found with about 90% of the Government's concentrated exploration effort during the last 5 years.

China has had less than 30 geological teams at work in Szechwan since 1954 in a basin that covers more than 80,000 sq. miles. The basin's oil finds so far have been very minor. The crudes found so far have been heavy, paraffin base oils.

Significance of the newly reported discoveries is their location. More than 80% of China's population lives south of the Yangtze River along the big nation's coastal regions. The new oil area is from 500 to 1,000 miles nearer the population and consumption centers than any oil in commercial quantities yet found in China.

Maracaibo Gas Plant Due

CIA. SHELL DE VENEZUELA will start work soon on a $24-million gas injection plant in Lake Maracaibo.

The plant will be built on a concrete platform about 20 miles due west of Lagunillas. It will compress 17,000,000 cu. ft. daily of gas collected from 12 stations in Block 1 of the company's lake holdings. The gas will be injected into Marron reservoir.

Centrifugal compressors driven by seven gas turbines will be the heart of the plant. The platform also will hold air-gas coolers, a control room, emergency equipment, and dining facilities. Gathering lines will consist of 16, 24, and 30-in. pipe.

The plant is expected to open the second quarter of 1959.

WORLD BRIEFS . . .

Ferngas, an Austrian company, will build a 45-mile, 12-in. gas line this year. The line will extend from Semmering to Donawitz. Contract has been awarded to Mannesmann, a German steel and construction firm.

National Iranian Oil Co. has awarded a contract to B. & M. Construction Corp., Oklahoma City, to extend its Abadan-Teheran products system with a 120-mile, 6-in. line northward from Teheran. The extension will give the Iranian Government company a products line across the country from the Abadan refinery on the Persian Gulf to the Caspian Sea.

The Texas Co. has resumed normal operations at its 20,000-bbl. refinery at Santiago, Cuba. The plant closed for 4 days during the political unrest, following a call for a general strike on the island by rebels. More than half the Cuban staff failed to show up for work.

India plans to drill three more wildcats with Russian aid. Two will be drilled in western India, in the Bombay and Hoshiarpur areas, and one in Assam. A Soviet rig and drilling crew is expected to arrive soon.

A 2-day fire which destroyed more than 225,000 bbl. of fuel oil in three tanks threatened the big Abadan refinery in Iran for a time last week. The blaze was put out without damaging the refinery. Reports from Iran indicated that the oil was ignited by a spark from a measuring device.

A new 50,000-bbl. daily crude distillation unit has gone on stream at the refinery on the southern coast of France where the newly discovered Sahara crude is being processed. The new unit will give the British Petroleum refinery at Lavera a daily throughput of 80,000 bbl. with an old 24,000-bbl. daily crude still held in reserve.

A two-company combine last week spudded its third deep wildcat in an effort to find oil in the Tanganyika-Zanzibar region of East Africa.

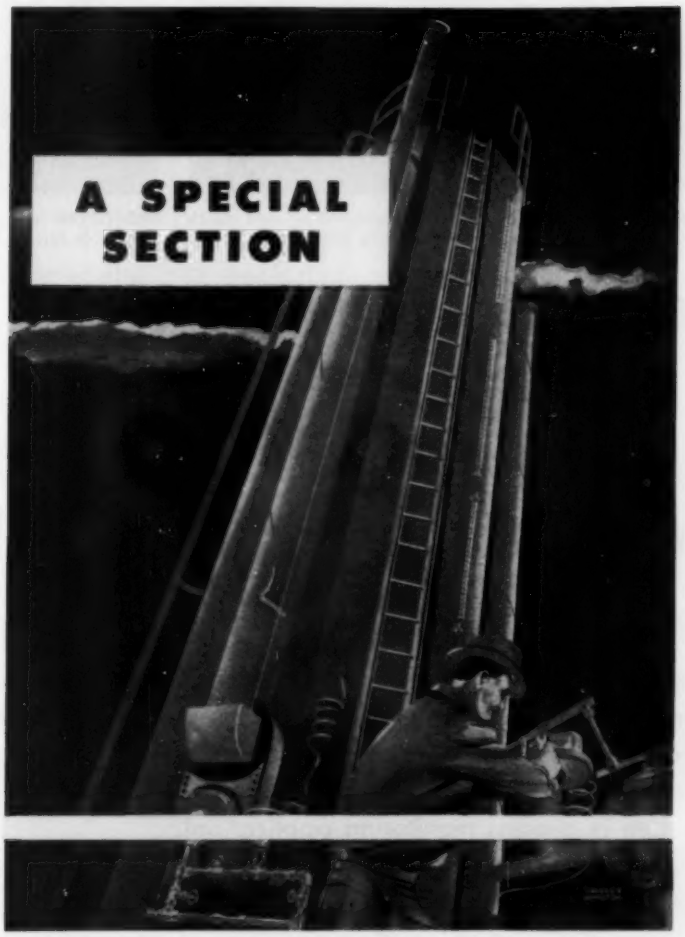
The new test got under way about 20 miles inland from the southeast coast of Tanganyika between Kilwa and Lindi. It is being drilled by the same heavy rig which earlier drilled an 11,051-ft. dry hole on Mafia Island and another 14,281-ft. duster on Zanzibar. The work is being done by BP-Shell Petroleum Development Co. of Tanganyika, Ltd.

The deepest well ever drilled in Nigeria has been abandoned as a dry hole. Ossiomo 1, near Benin City in western Nigeria, was bottomed at 12,063 ft. Another wildcat, Ikpe 1 in eastern Nigeria, has been abandoned at less than 9,000 ft. with no commercial show. Shell-BP Petroleum Development Co. is moving the rigs to new wildcat locations.

Several companies have arranged for aerial surveys of 60,000 sq. miles of concessions in Bolivia. Canadian Hunting, a Toronto-based firm, will make the surveys. Contracts total more than $500,000.

Europe's first alkylation unit has gone on stream at the 300,000-bbl. Pernis refinery operated by the Royal Dutch-Shell group near Rotterdam.

Field Processing...



FEATURING NGAA MEETING AND PAPERS

Forum...

What's new in CHROMATOGRAPHY

- **Monitoring and Control**
- **Stream Analyzer Pays Out Fast**
- **Automatic Attenuators Save Manpower**
- **Spot Checks on Tower Operations**
- **Guide to Fractionator Operation**

Plus **Are Your Specs Realistic? How Thermal Efficiency Lowers Costs**

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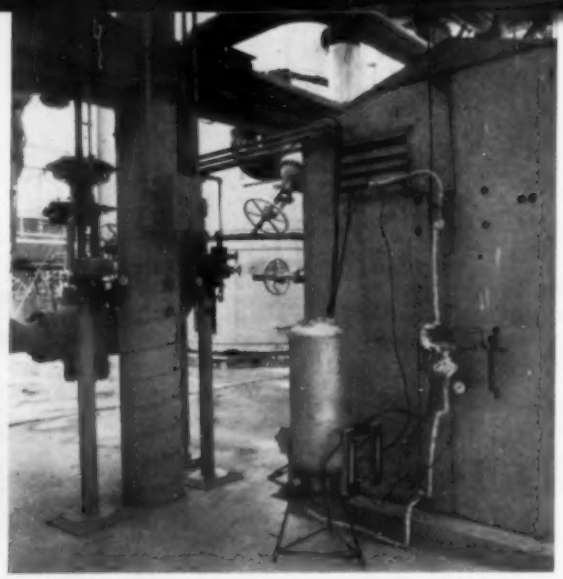
Plus **Journal's Annual Survey of Natural-Gasoline and Cycling Plants**

CHASSIS rack-holding recorder and programer and peak reader. The peak reader makes possible continuous output.



PROTOTYPE Model 184 analyzer was employed on column test. This has a 5-ft. silicone column and a 5-minute timer

Chromatography Forum

Monitoring and control with automatic chromatographic analyzers

In December 1957, a test run was successfully completed using a chromatographic analyzer to control a debutanizer column. This marks a new phase for chromatography and is a logical development following the use of this analytical tool first in the control laboratory and then in process monitoring applications.

BY M. M. FOURROUX
Phillips Petroleum Co.

THE DEVELOPMENT of a peak reader with continuous output makes it possible to use automatic chromatographic analyzers for process control. In a test run, a standard commercial chromatographic analyzer, with a 5-minute cycle, was coupled to the peak reader and used successfully to control a natural-gas-liquids debutanizer column. The analyzer, measuring isopentane on the ninth tray, controlled the steam flow to the reboiler through a temperature recorder-controller on the fourteenth tray. This cascaded control system provided stable, sensitive quality control.

1. MONITORING APPLICATION

The value of monitoring natural-gas liquids streams is easily recognized. During the past year, the overhead of a butane splitter was monitored for propane and normal butane as shown in Fig. 1. The amount of propane present is a good indication of how well the depropanizer operates. The butane splitter itself can be operated at close to maximum efficiency by keeping the normal butane in the overhead exactly at specification. From the same analysis, the purity of isobutane is known, by difference, to within a few tenths of a per cent. There is no need to run the column conservatively with this much information available every 15 minutes. Operating personnel would like to have other terminal streams under like analysis.

A successful monitoring application of a process chromatographic analyzer is described by Carlisle.[1]

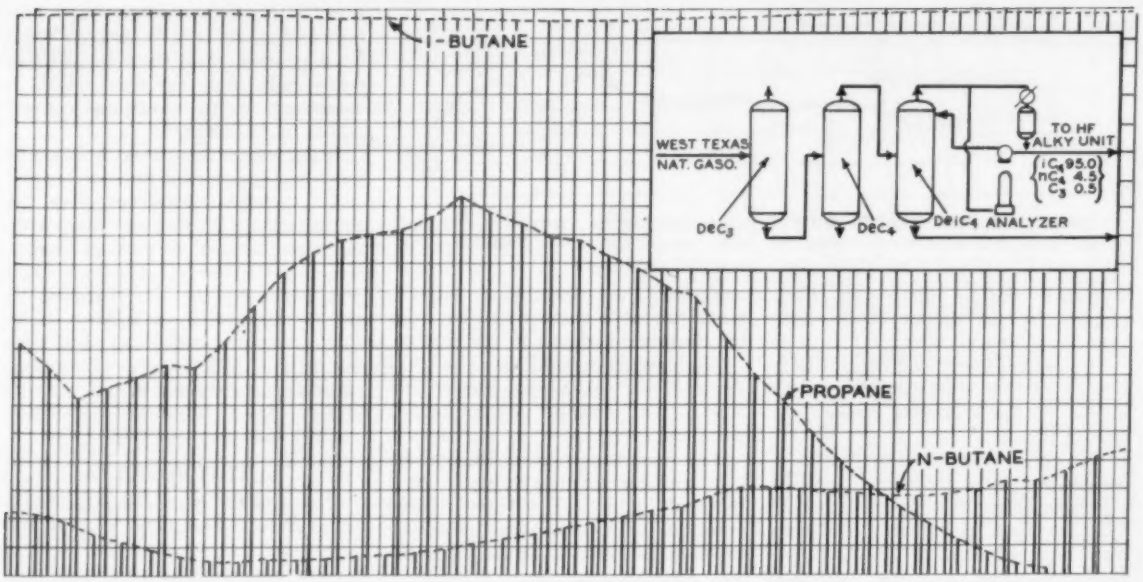
Paper presented at thirty-seventh annual NGAA meeting at Dallas, April 16, 1958.

2. FACTORS INVOLVED IN CONTROL

The use of a chromatographic analyzer in a feedback control system presents some interesting and challenging problems. These arise because a periodic rather than continuous analysis is provided. This is a serious difficulty which has been solved indirectly by a Phillips-designed device appropriately called a peak reader, described by Burk and Karasek.[2]

Peak Reader

The peak reader, tied into a standard chromatographic analyzer's programer, modified for this purpose, actually reads the peak height of the key component and provides an equivalent output signal which is constant and suitable for control purposes. When the component is read on the next cycle, the peak reader corrects itself and puts out a signal corresponding to the new peak height. The unsmoothed output of the peak reader is, therefore, a continuous signal with step changes corresponding to the



PROCESS MONITORING APPLICATION—The overhead of a butane splitter was monitored for propane and normal butane. By analyzing the stream it was possible to operate the butane splitter at close to maximum efficiency. Fig. 1.

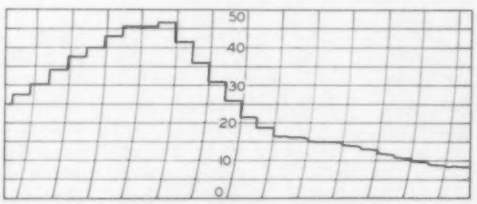
composition change of the key component. See Fig. 2.

Holdup time and process dynamics . . . The holdup time or analysis time of the chromatographic analyzer must be evaluated with respect to the dynamics of the process being controlled. The use of chromatography for control will be limited to those processes which can stand the delay resulting from analysis time. As known high-speed techniques[3] are incorporated into commercial chromatographic analyzers, the analysis delay will be greatly reduced. Programers also will have to be redesigned to handle the cycles of 30 seconds or less. **This is just a matter of time—hence the bright future for control by chromatography.**

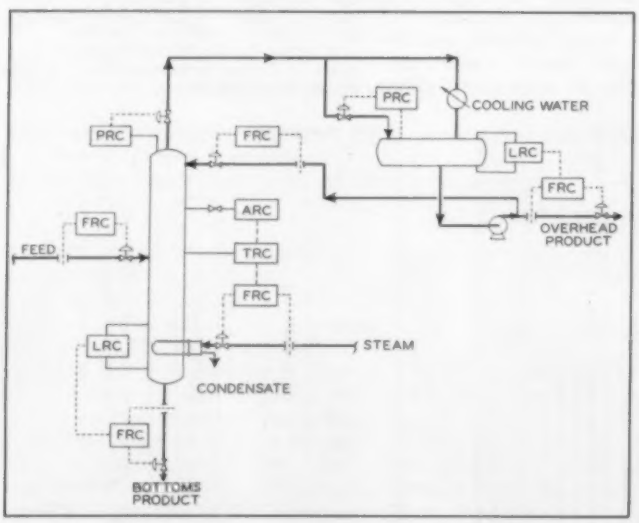
3. A CONTROL SYSTEM

To evaluate the peak reader and to establish the feasibility of control by chromatographic analyzer, the following control system was set up on the debutanizer, as shown in Fig. 3.

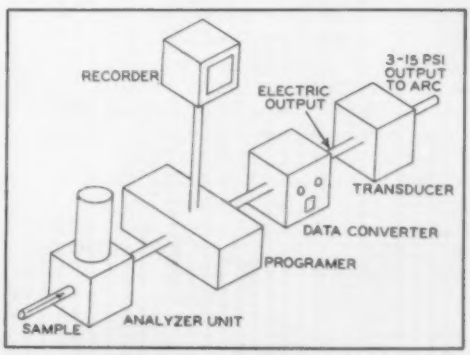
Analyzer in cascade . . . The rate of flow of steam to the reboiler is the manipulated variable. Control is obtained by a flow recorder-controller whose control point is readjusted by the output of the temperature recorder-controller on the fourteenth tray (from top). The temperature recorder-



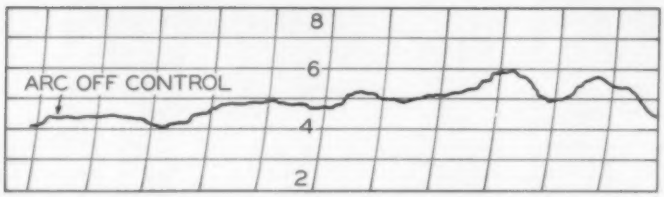
PEAK READER OUTPUT on debutanizer, 0-10% isopentane. This is unsmoothed output of the peak reader, coming out with step changes. Fig. 2.



FRACTIONATOR CONTROL SYSTEM with output of analyzer recorder-controller adjusting the TRC set point. Control point of FRC is reset by TRC output. Fig. 3.



PROCESS CHROMATOGRAPH block diagram in which the isopentane peak height is read. The signal is amplified and presented to an electric-pneumatic transducer. Fig. 4.



SMOOTHED PEAK READER OUTPUT made possible by restrictor put in pneumatic line between transducer and recorder-controller. Fig. 5.

controller control point is, in turn, adjusted by the output of the analyzer recorder-controller.

The measurement and control loop consists of individual components arranged in the following manner, as seen in Fig. 4.

The chromatographic analyzer, under control of the programer, samples a portion of gas flowing continuously from the ninth tray to vent. The sample is then admitted to the chromatographic column, and the individual components come out on schedule. When the key component, isopentane in this case, comes into register, the peak reader, also under control of the programer, reads the isopentane peak height. Once read, this signal is amplified and presented as a steady signal to an e.m.f.-air transducer. This air signal is the input signal to the analyzer recorder-controller.

Before describing the test proper, details on the unit and the control equipment may be in order.

4. COLUMN AND CONTROL EQUIPMENT

The debutanizer column is 13 ft. in diameter, 120 ft. tall, and has 50 trays. Its purpose is to debutanize natural-gas liquids which have already been depropanized. Loss of butane through the bottoms should be negligible, and just a few tenths per cent isopentane should be allowed in the overhead product. This can be accomplished by controlling the isopentane on the ninth tray at a value consistent with the operating variables of the column.

The chromatographic analyzer is a Perkin-Elmer prototype Model 184 with a 5-ft. silicone column and a 5-minute timer.

The peak reader is of Phillips design and has either a 0-50-mv. or a 0-50-volt output. The latter is used with an e.m.f.-pneumatic transducer between the peak reader and a standard recorder-controller. In order to smooth the stepwise output of the peak reader, a restrictor was put in the pneumatic line between the transducer and the recorder-controller. This smoothes the trace somewhat as is evident in Fig. 5.

5. THE TEST RUN

The test run of the control system described above was of 1 week's duration. Isopentane at the ninth tray was maintained within ±0.2% at a level of about 2.5% except for one slightly higher deviation resulting from the following.

Upset . . . During the test run a severe feed rate and composition disturbance occurred. An instrument failure caused the steam to the preceding column, the depropanizer, to be completely shut off. The debutanizer was, of course, affected, and the chromatographic control system corrected for this in a relatively short time, as shown by the isopentane content in Fig. 6. The largest deviation of isopentane from its set point was 0.6% right after the disturbance. A completely stable condition was attained in 90 minutes.

Inasmuch as there is no freedom of manipulation of feed rate (or composition) to the debutanizer from the depropanizer, this recovery time, without losing control of product quality, was not considered excessive. This was essentially the time required by the depropanizer to settle down. However, there are indications that, with an analysis cycle of, say, 15 minutes, unsatisfactory control would have resulted. Apart from this one upset, control was very smooth.

6. TEST RESULTS

This test run provided information to design an automatic control system, using a chromatographic analyzer on the debutanizer in the revised fractionator flow plan, as per Fig. 7. In this configuration, butane and propane are to be removed in the first column. As in the test run, isopentane will be monitored and controlled near the top of the column at whatever level is necessary to allow just a trace of isopentane in the overhead.

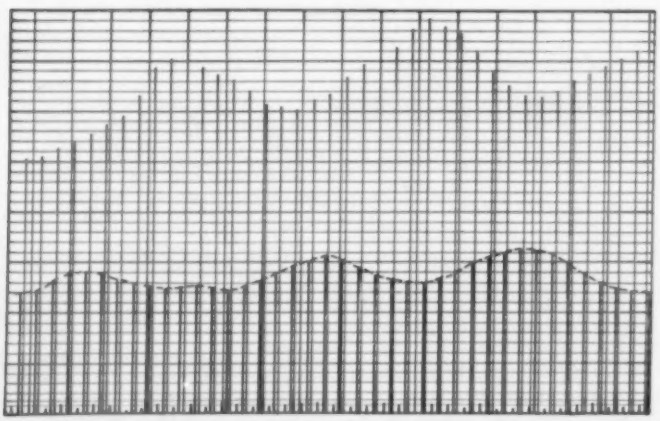
This test run shows that good control by chromatographic analyzer is attainable, and that the cascade control system described here provides stable, sensitive quality control.

References

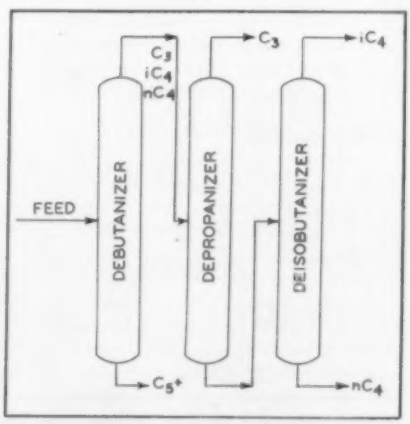
1. Carlisle, L. J., "Application of the Gas Chromatograph to Petroleum Refining." Presented at Gulf Coast Spectroscopic Society meeting, Houston, February 1958.

2. Burk, M. C., and Karasek, F. W., "Automatic Process Control With Chromatographic Analyzers." Phillips Petroleum Co. report. Presented at the annual symposium on instrumental methods, Houston.

3. Ayers, B. O., "Chromatographic Analyzers in Process Instrumentation," Phillips Petroleum Co. report.



BAR GRAPH OUTPUT for 0-1.0% propane and 0-10% isopentane. Peaks are traced showing effect of disturbance from preceding column. Fig. 6.



REVISED FRACTIONATION system now being tested with chromatograph analyzer. Fig. 7.

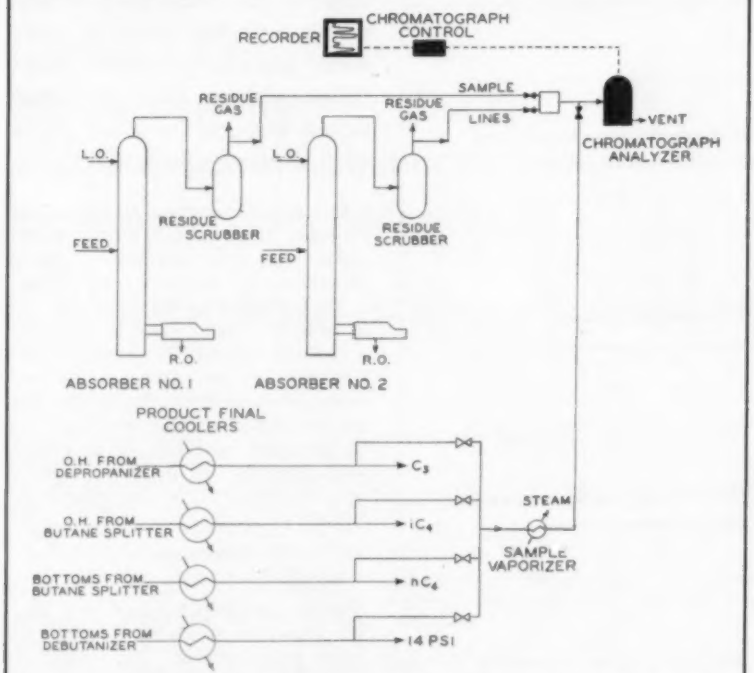


DIAGRAM OF SAMPLE CONNECTIONS for chromatograph used at Snyder gasoline plant. Continuous analysis aided in making changes in operation that resulted in increased propane recovery. Fig. 1.

Chromatograph has quick payout at Snyder plant

Stream analyzer results in propane-recovery increase which in a single month resulted in a gain of $10,500, or more than two times the cost of the equipment.

BY BRUCE DENNY
Sunray Mid-Continent Oil Co.

THE PROCESS MODEL chromatograph was received at the Snyder plant late in October 1957. Working under the direction of the engineer furnished by the manufacturer, the instrument was assembled in a temporary location and was analyzing two residue-gas streams in less than 1 day. It required about 10 days for the personnel to become familiar with certain aspects of the installation such as calibration, adjustment of the automatic timing mechanisms, and regulation of sample and carrier-gas pressures and rates to obtain the desired reproducibility.

Paper presented at thirty-seventh annual NGAA meeting at Dallas, April 16, 1958.

Original Installation

In the original installation, residue gas from the two deethanizing absorbers was supplied to the analyzer. These two streams are connected to a three-way solenoid valve and are manually switched into the sample inlet line. From this point on the operation is fully automatic and the stream analysis is made every 15 minutes. The hookup was later modified to include any one of four product streams to be introduced into the analyzer through a sample vaporizer and programed for a continuous analysis.

Following effect of changes . . . The aid of this instrument to process operations was immediately evident. A change in any operating variable on the absorber, such as oil rate or reboiler temperature, would reflect in residue composition in the following 15-minute sample. This frequent sampling enabled the operator to see actually what was happening in the tower and it could be immediately compensated. The process operator, knowing that the absorber overhead is the only place that products can be lost, became very recovery conscious and relies heavily on the overhead analysis as a guide to control.

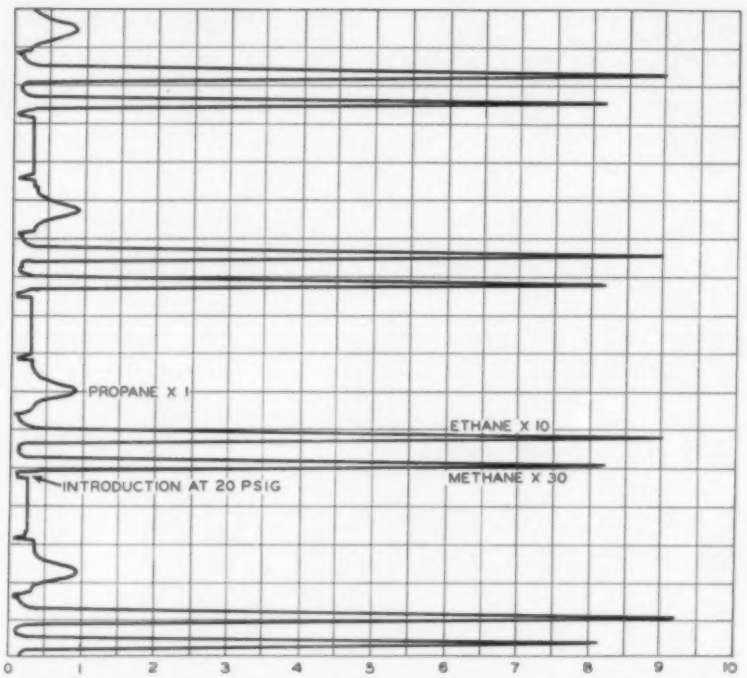
What Continuous Analysis Showed

The continuous analysis of the residue gas made evident the need for revising two of the operating techniques that were in use at the time.

Ratio controllers . . . First, the lean-oil rates were manually controlled by sight reading of the inlet-gas volumes; therefore, the oil-to-gas ratio varied considerably and the propane recovery varied likewise. A series of tests were set up to determine the oil-to-gas ratio for maximum recovery and after having determined this, ratio controllers were put in service and the recovery is now constant.

Lower L.O. temperatures . . . Second, operating experience had shown that to operate the absorber with lean-oil temperatures much below 80° F., there was a tendency to flood the tower. This condition was brought about by excess lean-oil rates and excess reboiler temperatures for specification propane. With the oil rate on ratio control, the oil and gas coolers now operate at capacity and temperatures as low as 56° F. have been recorded. The propane content of the inlet gas is about 5.25 g.p.m., and some residue analyses have been recorded at 0.05 g.p.m.

Ethylene buildup . . . One other absorber operating problem was occurring during the end of the month when inlet gas volume to the plant



CHROMATOGRAPH ABSORBER RESIDUE ANALYSIS at Snyder plant. Such analysis aided in early detection of ethane buildup in the absorber residue. Fig. 2.

decreased rather rapidly. It had been noted for some time that when this volume decreased to about 38,000 M.c.f.d. the propane vapor pressure would tend to rise out of the control range. To compensate for this the temperatures were generally elevated to such a point that the overhead losses were excessive. The available continuous analysis pointed out the exact point that this disturbance began by showing a decrease in ethane content in the residue. It was then recognized what was happening in the absorber. An ethane buildup was beginning. Heretofore, without knowing when to make the operating change, this would get out of control. The operating changes can now be made at the moment they are needed.

Four Product Streams

It is possible to put any one of the four product streams into the analyzer for continuous analysis. The present column in the analyzer is not suitable for the natural gasoline but one can be installed for this product. The propane, isobutane, and normal-butane streams have been run. The continuous analysis of the propane stream has enabled the operators to trim the depropanizer operation to such a point that a minimum of the higher-priced isobutane is left in the propane. Also, the butane-splitter operation has been checked to verify conditions for isobutane purity.

"The chromatograph can also be adapted to a manual sample entry and a manual control for analyzing extraneous samples such as gas-well gases, products from other plants, and gas and liquid streams in other parts of the plant operation."

The chromatograph can also be adapted to a manual sample entry and a manual control for analyzing extraneous samples such as gas-well gases, products from other plants, and gas and liquid streams in other parts of the plant operation. It is considered, however, to be most valuable as a monitor for the two residue-gas streams.

Maintenance

There are no particular operating problems to the instrument if the sample lines are properly designed for quick purge effects. The instrument maintenance is something that will come as a result of the training of the plant electrician to make the necessary checks and repairs. It is planned to use the manufacturer's service man for 1 year and after that it is felt that the plant personnel can do the required maintenance. The operating cost for a 24-hour period amounts to about $1.34 for helium and chart paper. This can be reduced by using the back side of the chart and a strict control of helium flow rates.

What Was Saved

The value of this instrument to the Snyder plant operations has been recognized by all concerned. The plant personnel have become surprisingly recovery conscious. The increase in propane recovery resulted in a gain of $10,500 for December 1957, over the October operations (see Table 1). This is more than two times the cost of the chromatograph. These increased earnings plus the improved operating conditions have led the Snyder plant employes to become rather enthusiastic and boastful about this installation.

TABLE 1—ECONOMICS OF PROPANE RECOVERY SINCE CHROMATOGRAPH INSTALLATION—NOVEMBER 1, 1957—AT SNYDER GASOLINE PLANT

Take the propane recovery in gallons per thousand and the amount of heater fuel used in cubic feet per total gallons of product. The totals for the month of October are used as the base figures.

	Propane recovered		Heater fuel used		Dollars gained	
Month—	C_3 recovery g.p.m.	Diff. from prev. mo. g.p.m.	Heat fuel, ft.³/gal.	Diff. from prev. mo. ft.³/gal.	Since prev. mo.	Since October
October (31)	5.024	.....	7.764	.....	.....	.....
November (30)	5.052	+0.028	7.718	−0.046	$1,100	$ 1,100
December (31)	5.303	+0.251	7.866	+0.148	9,400	10,500
Total						$11,600

Notes:

1. Average daily gas load is taken as 41,000 M.c.f. per day; average daily production of 404,000 gal. per day.
2. Propane taken at 3 cents per gallon; heater fuel taken at 10 cents per M.c.f.
3. This $11,600 is the gain in propane recovery (taking heater fuel into account) over October's operations.
4. The operation of the chromatograph costs $1.34 per day or $41 per month.

Acknowledgment

Acknowledgment is made to Manning Davis, laboratory foreman, under whose direction the installation was made and is being operated, and to Dana L. Smith, junior engineer, who worked closely with the operating people and tabulated and reported the details of the use and results of this instrument.

Humble's Baytown refinery laboratory analyzes about 2,000 samples each month. Experience there indicates

Chromatography is a plant workhorse

- Benzyl cellosolve is best as light substrate
- Use of automatic attenuators saves manpower

BY J. F. HICKERSON
Humble Oil & Refining Co.,
Baytown, Tex.

THE LABORATORY has four commercial chromatographs. Two of these are the single-column apparatus having thermistor-type detectors. The other two are double-column equipment with filament-type detectors. The single-column chromatographs are used in the same general service at all times, while the double-column equipment is frequently varied as to the type of samples on which they are used. On the single-column apparatus the temperature gas flow and other conditions remain constant at all times.

Both types of equipment are equipped with reverse-flow arrangement so that heavy ends can be back flushed from the columns. However, there are certain types of samples which have considerable amount of heavy ends and it has been found advantageous to flush this heavy material from the column on a separate flushing apparatus. This apparatus is equipped for back flushing with nitrogen and also has facilities for heating the columns.

Automatic Attenuators

All of the equipment has automatic attenuators. By this arrangement when a peak is encountered which reaches 90% of full-scale deflection, multiplying factors of 10 or 16 are automatically thrown in so that the peak remains on the chart. After the peak is passed, another switch is tripped so that the sensitivity is returned to its original value. This is accomplished by means of a cam on the recorder which actuates two microswitches.

When the recorder pen reaches 90% of full scale, one switch brings in an additional resistance to the input to the recorder and cuts down the signal. When the signal gets low enough, a slot in the cam actuates the other switch and returns the instrument to the original sensitivity.

Paper presented at thirty-seventh annual NGAA meeting at Dallas, April 16, 1958.

Liquid substitutes . . . All of the partition columns use C22 fire brick as a solid support. Two types of liquid substrates are used, benzyl cellosolve and octoil. Each of them are used in about 35% by weight on the fire brick. In general the two substrates are used for the same separation, but it is found that the benzyl cellosolve columns will make the separations more efficiently. Octoil is employed satisfactorily at higher temperatures. The columns are generally run at about 40° C. and helium is used as a carrier gas. Thirteen A molecular sieves are used for the analysis of methane and lighter gases. This column is operated at 170° F. with argon as the carrier gas.

Calibration . . . Each column is calibrated by means of pure compounds to determine the retention time, and synthetic mixtures are used to determine the factors for quantitative analyses. Phillips synthetics are used for calibration when they are available. However, it is necessary to prepare many of the synthetic mixtures in the laboratory.

In some cases these are prepared by adding measured amounts of pure gas by means of a hypodermic syringe into a vessel containing mercury as a confining liquid. Synthetics accurate to about 0.2% of the total can be prepared in this manner. A special blending apparatus is usually used to prepare other synthetics when more accuracy is required.

Monitoring . . . Nearly all analyses are calculated using peak heights to decrease the time required for calculations. This can only be done because each column is calibrated specifically for each compound. It does require that the results be constantly monitored to insure that the calibration is still valid. This is accomplished by means of standard samples run at intervals of about 1 in every 20 analyses. Control charts are kept on each column so that trends can be detected. This technique is used to monitor analyses of all kinds in this laboratory.

Handling LPG

Liquefied petroleum gas is sampled into a double-chambered sample bomb. The bomb is completely evacuated and liquid entered into the small chamber. All the liquid is allowed to vaporize into the larger chamber and is mixed thermally. The larger chamber is about 200 times the volume of the small one.

The same technique has been used to vaporize natural gasoline samples in which case volume of the larger chamber has about 3,000 the volume of the small one. In this instance the pressure after vaporization is about 200 mm. absolute. The sample is then

mixed with helium and brought up to slightly above atmospheric pressure. This technique is used on samples which can be analyzed completely and the results normalized.

Gas to column . . . A gas valve is used to enter the gas into the columns. In this valve, gas is allowed to flow into the fixed volume and is trapped. Turning the valve allows helium to flush the gas into the column. On some samples in which there is insufficient amount of gas, a hypodermic syringe is used. In this case the gas is entered into the hypodermic and into the column through a serum cap.

If the gas is at atmospheric pressure or below, a special pump is used to repressure the gas to atmospheric pressure. It is pumped into a neoprene tube and the sample entered then by means of the hypodermic needle. Low - vapor - pressure liquid samples are entered into the column by means of micropipettes. Samples with vapor pressures between 10 and 25 lb. are charged by means of the constant-volume stopcock. In this arrangement the liquid fills the stopcock and is turned then so that the helium flushes the liquid directly into the column.

Liquid samples with a higher vapor pressure are charged to the column by means of a special metal metering valve. The valve consists mainly in a small-diameter cylinder which can be closed at both ends by a spring-loaded cap with a neoprene seat. The valve is filled with liquid and both caps are closed, trapping the liquid in between. The excess liquid is evacuated, helium pressure is applied and the caps opened, forcing the sample into the column.

One man required . . . With the equipment arranged as it is, no manpower is required for operation after the sample is charged. One person can operate all of the four pieces of equipment and do most of the calculations. He has to see that the equipment is under the right conditions for the sample to be analyzed, charge the sample and come back at a later time and tear off the chart. While one sample is running he can calculate another. With the use of the automatic attenuators less emphasis is placed on rapid analyses. The equipment is operated most of the time 24 hours a day, 7 days a week, and about 2,000 analyses are performed each month.

The octoil columns . . . These are used to analyze samples for iso and normal butane, and iso and normal pentane. On the benzyl cellosolve columns it is possible to analyze for the individual compounds C_2 through C_6's and part of the C_7's. The same columns will also determine the individual olefins except for isobutylene and butene-1. The 13A molecular sieves are used mainly for flue gases in which hydrogen, methane, oxygen, nitrogen, and carbon monoxide are determined.

Although the operation is designed for minimum manpower requirements, the analyses are fairly rapid. LPG type samples can be analyzed through n-butane in about 5 minutes instrument time. An analysis through n-hexanes require about 20 minutes instrument time, while samples can be analyzed for the C_7 paraffins in about 35 minutes. The accuracy in general is about 0.3% standard deviation.

This analytical technique has been found to be very helpful in analyzing natural gasoline fractions in various stages of refinery operation. The results are used for control of unit operations, for data on refinery yield, and for accounting.

Chromatography Forum

Here's how

Gas chromatography works in the laboratory

Where spot checks on tower operations are necessary, the chromatography instrument can give reliable, fast analyses.

BY L. N. LOCKE
Continental Oil Co., Ponca City, Okla.

CONTINENTAL Oil Co. entered the field of chromatography when the Central Research Laboratory ordered a Perkin & Elmer model shortly after they were advertised in 1955. The Perkin & Elmer unit arrived in the late spring of 1956, and Continental was in the fast-growing field of analysis by chromatograph. Since that time, the development and research department has added three commercial and three or four homemade units to their various analytical sections.

Chromatography for Lab Control

The Ponca City refinery laboratory decided not to wait for the development and research department to develop this new analytical tool for control use and plunged into the chromatography field on its own. It was soon discovered that the varied analytical problems of research are quite different from those of a refinery-control laboratory.

Development of suitable equipment, columns, and techniques for the problems encountered in any operation takes more time and work than one would at first think. For this reason, the refinery laboratory is happy that it started into the chromatography field when it did.

The Ponca City refinery control laboratory built its first unit in the late summer and early fall of 1956. This unit contained a thermal-conductivity cell of the thermistor type as a detector and contained the necessary liquid and gas-sampling valves. Shortly after this, in the fall of 1956, a commercial model was purchased—a Burrell K3. Since that time, another Burrell K3 has been purchased for one of our other refineries, and four homemade units are currently being finished for the rest of our refineries.

Three homemade units will contain certain equipment that we favor at this time, i.e.: (1) a gas-sampling valve made of two four-way glass stopcocks, (2) the thermistor-type detector cell (Victory Engineering Co.),

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Chromatography: valuable adjunct in analytical techniques

and (3) a four-way valve for reversing the flow in a column.

Cat Reforming Application

The first problem that the refinery laboratory took up was one of analyzing the naphtha feed and the reformate from our reformers. We found that the light-naphtha charge stock for benzene production was much nicer to work with than the heavier motor-gasoline reforming stocks. The light naphtha and the resulting reformate have an end point of about 250° F.

Longer column needed . . . Using a commercial column about 7 ft. long with Octoil S as the substrate. we were able to separate and identify the naphthenes and aromatics which we felt would enable us to follow the reforming operation. These hydrocarbons were methyl cyclopentane, cyclohexane, dimethyl cyclopentane, methyl cyclohexane, benzene, and toluene.

However, and this is a very large "however," there were certain paraffins under the naphthenes identified above. This problem lead to the search for a longer column to do the job of separating the naphthenes and those paraffins occurring at the same place in the chromatogram.

By using 13 ft. of silicone 710 followed by an oil blend of a sulfonated type of lube oil additive, dimethyl sulfolane, and Octoil, we were able to get complete separation on all but dimethyl cyclopentane. Calibration was made by use of blends of the desired naphthenes and aromatics and also by use of naphtha and reformate analyses furnished by UOP on our own stocks.

Back to shorter column . . . We have since identified the paraffins that are eluted at the same time as the desired naphthenes, and are getting a good look at the profile of the naphtha and reformate. This has enabled us to resume use of the shorter columns while making allowance in our calibration curves for the submerged paraffins. We use the internal standard technique, since this enables us to look at only those components in which we are interested.

Control samples are being analyzed daily on reformer naphtha, reformate, and six control points in the aromatic extraction unit. These analyses are run at 200° F. and take about 30 minutes, including calculation time.

Analyzing Light Hydrocarbons

Our second problem was that of analyzing the light hydrocarbons for plant control. Since the refineries are interested in unsaturates as well as the saturates, the question of a suitable column to handle this problem came up.

Choice of substrate . . . After considerable column substrate trials, our first satisfactory column was one of 20 ft. dimethyl sulfolane and 4 ft. hexadecane. The hexadecane was used to move the C_5 paraffins out from under the C_4 olefins. There are several paraffin substrates which would work as well.

This column has the advantage of being able to operate at elevated temperatures—as high as 150° F. This column will analyze for C_1 through nC_5 in about 20 minutes and separate all the olefins except ethylene and the isobutene-butene-1 split. It will also give CO_2 between C_2 and C_3.

Other substrate . . . Since then we have found that n-butyl maleate and hexamethyl phosphoramide will do satisfactory separations with shorter columns. The maleate column is best operated at 130° F. and the phosphoramide at room temperature. Our present choice is 12 ft. of the phosphoramide which can be operated at room temperature and will elute n-pentane in about 15 minutes. If several columns were to be housed in a common elevated temperature bath, the maleate might be a better choice.

Light HC liquids run . . . Control samples that are run by this method are depropanizer OH liquids, debutanizer OH liquids, LPG propane, and other similar samples. These samples are entered by purging slowly through the gas-sampling valve at a constant rate and trapping the sample loop full of gas. On light liquids, samples of propane with quite a bit of ethane, we find that a heated valve is necessary to secure a steady flow rate.

Uneven flows, caused by a freezing-flow regulator, will cause droplets of liquid to enter the sample loop where weathering of the sample may occur. As a temporary measure, the control valve on the sample bomb may be heated with hot water prior to use.

Residue Gases

Residue gases are also of prime importance in the refineries. In the Ponca City refinery laboratory, we have a Consolidated 620 mass spectrometer; and we run most of our residue gases in this way. In our smaller refineries, these gases must be run by Pod columns; but will soon be handled by chromatography. We have not as yet perfected the combination molecular sieve-regular hydrocarbon column for determination of hydrogen, oxygen, and nitrogen as distinct from methane.

This seems to have the best possibility, and we will develop it further in the near future. At present we are using a technique whereby we remove oxygen, CO_2, and H_2S by Orsat, hydrogen by copper oxide-burning method, and then the hydrocarbons are run by chromatography on the remaining sample. After the necessary calculations are made and answers combined, a very satisfactory analysis is available.

Stabilized Gasoline

Another type of sample that the refinery laboratory is interested in is the stabilized gasoline for determining the pentane and lighter components. Most of these gasolines are still run by Pod columns, but the lab is moving toward eventual analysis by chromatography. The technique being used at present is to admit a uniform size and temperature liquid sample into the sample loop of a gas-sampling valve. This has been accomplished by placing a rubber septum in a spare sample loop. This loop is used only on gasolines, and a small piece of pipe cleaner is used as packing to receive the liquid sample.

After each sample, a new piece of pipe cleaner is substituted. The helium gas strips the light ends from the sample loop; and after the air peak (approximately 2 minutes) shows on the chromatogram, the sample loop is bypassed for the remainder of the run. Calibration can be made based on an internal standard or on the area of individual components—assuming a constant-volume gasoline sample.

Calibrations have been made by use of Podbielniak analyses primarily, with some use of Phillips standards.

All analyses are calculated on the peak area basis. The area per cents are then corrected by use of factors to either mole per cent or liquid volume per cent. We are at present trying peak height measurements on a limited basis.

In sum: For a refinery control laboratory, chromatography is a valuable advancement in analytical techniques. Where spot checks on tower operations are necessary, the chromatography instrument can give reliable, fast analyses. This sort of service should encourage refinery-operating personnel to make frequent checks on their operations.

Chromatography has become a valuable tool as a guide to fractionator operation

Many control tests such as vapor pressure, distillation, and weathering have been completely eliminated by the chromatograph.

BY A. B. ALTOM
Warren Petroleum Corp.,
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ASSUME we are operating a depropanizer receiving deethanizer charge. The base charge from this depropanizer is the charge to a debutanizer. And the overhead product of the debutanizer is the charge to a deisobutanizer.

To operate this fractionator efficiently it is necessary to know the composition of the charge. If there is a variation in composition of the charge you must know the range of the variation in order to set properly the operating conditions to compensate for these composition changes.

There are many occasions when a complete analysis on the charge is not necessary but, at the same time, it is imperative to know the per cent of ethane, if any; the per cent of propane, isobutane, normal butane, and isopentane plus.

Reversing Technique

By using a recently developed technique this type of analysis can be made in less than half the time normally required for a complete analysis. By using a reverse flow valve and and a reverse polarity switch on the chromatograph you can make a quick check on the feed to the fractionator. To do this you may run the sample until you have a peak on ethane, if any is present, propane, isobutane, and normal butane, then by reversing the flow of the carrier gas and reversing the thermocouple connections of the recorder, heavier end products will show up on your chart as one peak. The time required will be twice the time required to get through the normal butane.

Determining control point . . . The proper control point on the fractionator must be determined. To do this it might be necessary to analyze samples from various points on the fractionator and again the speed and accuracy of the chromatograph makes an invaluable aid.

If there is reason to believe that conditions are such that isobutane is being driven to a point up into the fractionator this can be quickly checked and corrective measures taken. The overhead product of propane can be quickly analyzed by the chomatograph to see if proper purity is being maintained while an analysis on the base product from the fractionator will determine whether or not any propane is being left in the feed to the debutanizer. Again the reverse flow and reverse polarity technique is helpful.

Propane-free bottoms . . . By running chromatographic analyses as you change operating conditions you will get much valuable information and can determine just what is taking place in the fractionator. Since the base product of this fractionator is charge to a debutanizer which in turn charges the deisobutanizer with its overhead product, it is essential that the base product be as near propane-free as possible.

Most operators who have deisobutanizers in operation have experienced great difficulty in getting propane-free charge to the deisobutanizer stabilizer and a very reliable and fast means of checking the propane content of that charge is of great value to the operator.

Since the plant charge to many plants over the country has a relatively small percentage of isobutane, a very small amount of propane left in the base product may be enough to make the isobutane below the percentage specification that the plant is striving to maintain. This not only results in an off-specification product but also upsets the operation of the debutanizer. By sampling the base product of the depropanizer the operator knows within minutes that an adjustment must be made if certain predetermined percentages of propane are indicated on the analysis.

Checking the Debutanizer

The operation of three separate fractionators has been mentioned in this article with probably greater emphasis being made on the operation of the depropanizer and the deisobutanizer. Practically the same procedure is applicable to the debutanizer in that to operate efficiently it is necessary to make similar spot checks on the charge, overhead product, and base product. The aforementioned analyses which include spot checks on charge to fractionators, various tray-level samples, and overhead products give the operator some valuable information and also can become important permanent records on product purities under various operating conditions.

During the start of a new plant recently the lab testers have been able to accomplish in minutes such analyses as the separation of the components of charge to fractionators, overhead products, or various samples at different tray levels in a matter of minutes.

Since chromatographic analyses can be substituted for regular laboratory control tests and can be run in less time with a much higher degree of accuracy by relatively unskilled laboratory personnel, the chromatograph is rapidly becoming one of the most valuable pieces of control laboratory equipment. Many control tests such as vapor pressure, distillation, and weathering tests have been completely eliminated by the chromatograph, resulting in increased accuracy and a decrease in time consumed running such tests.

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Are your specs realistic?

A good set of mechanical specifications can be a most useful tool in plant design. They can, and should, be a guide to the building of an economic and safe plant. Unfortunately, specifications have a way of getting out of hand and can easily become a collection of obsolete rules and prejudices from the past. To be truly useful, a set of specifications must be continually, thoughtfully, and critically reexamined in the light of present-day conditions.

BY N. C. TURNER
Hudson Engineering Corp.
Houston

THIS IS A GOOD time for all of us to look for opportunities to reduce the initial cost of a gasoline plant.

The first opportunity comes even before the conception of the plant, for general mechanical specifications have usually been prepared even before a specific plant is projected. And it is in the preparation of these specifications that our first opportunity to economize presents itself.

Let us consider some examples of specifications that, in the interest of economy, might be of questionable value. The examples we are about to give are merely possible instances where certain rigid specifications should be questioned. There are undoubtedly circumstances where they would be entirely satisfactory.

1—Pumps

The API Specification No. 610 for process pumps provides a simple, and in most cases, wholly adequate set of specifications for pumps of this type. Attempts to change or supplement these specifications can frequently result in a more expensive pump with little or no benefits to be received from this additional expense.

Depth of stuffing box . . . For example, we have seen specifications governing the depth of the stuffing box of centrifugal pumps in which this depth is specified in some fixed ratio to the shaft diameter. The specifications take no consideration of the shaft speed, the material being pumped or the pressure against the stuffing box. With the many factors involved, it might be best to leave the determination of the proper stuffing-box depth to the pump designer, particularly since most process pumps today are now equipped with mechanical seals and the depth of the stuffing box is not particularly important. Some specifications set the number of rows of bearings. There is some doubt that this is advisable. There are instances in which a single row of bearings may be preferable to two rows.

Impeller diameter . . . Some specifications contain the requirements that the pumps should be so selected that the impeller diameter should not be more than 80% of the maximum impeller which the particular pump casing could accommodate. This is a provision to permit increase in the pump capacity at some future date. On multistage pumps with relatively small impellers, it is not unusual to find that the **minimum** impeller diameter is greater than 80% of the maximum diameter, and that the 80% requirement may force the offering of a much larger and more expensive pump than is necessary.

NPSH . . . Many unnecessarily large pumps have been purchased because of unrealistic specifications of NPSH requirements. If 15-ft. NPSH is available, the purchasing of a pump for a 6-ft. NPSH is an expensive luxury. It may be argued that the low NPSH is specified in anticipation of possible change in the pump-service requirement at some future date. It is doubtful if such changes in service occur often enough to justify the additional initial expense of buying a larger pump.

Motor . . . It is common practice to specify that a pump shall be so motored that the motor will not be overloaded at the maximum horsepower on the pump curve. This is usually excellent practice but there are exceptions. Consider the case where a larger pump has been selected because of NPSH requirements. In such instances the horsepower requirements at the maximum point on the curve may be several times the horsepower requirement at the rated load. A smaller driver would not have been overloaded because the limiting NPSH would be reached before the volume of liquid could be increased to produce the peak horsepower. There are times when water-jacketed bearings are specified when better bearing performance would be obtained without water cooling. There is less tendency for water to condense in the oil of a hot bearing and destroy its lubricating value. A hot-running bearing is not necessarily a malfunctioning bearing.

2—Pressure Vessels

There are many general specifications for pressure vessels which involve arbitrary rules that increase the expense of fabricating the vessel, with little or no benefit in return.

Plate thickness . . . It is quite common practice to specify minimum plate thickness for all vessels regardless of size or nature of service. This sometimes results in plate thicknesses which are greater than necessary. It is also customary to include in the general specifications a corrosion allowance to be included in all vessels. Corrosion allowance should be specified realistically. Where there is no reasonable possibility of corrosion, it would be economical to omit the corrosion allowance. Some specifications forbid the use of builtup nozzles on the vessels and require forgings. The pressure vessel code permits the use of builtup nozzles and in many instances they are considerably cheaper

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than the corresponding forged nozzles.

Internals . . . Some specifications require that internals, such as trays, be bolted to the vessel. To do this with light vessels presents some problems and entails additional fabricating expenses since trays are usually installed in the tower when it is in a horizontal position. This operation can be eliminated if tray-holddown clamps are used rather than bolts. The hole pattern on perforated trays is frequently laid out without regard to the manner in which these trays are manufactured. The individual plates are frequently shown with blank areas adjacent to the support members. In order to fabricate plates on patterns of this type, it is necessary that the holes be laid out by hand and drilled with a drill press. If the entire plate can be perforated, it can be very economically accomplished by means of an automatic multiple punch machine.

3—Heat Exchangers

Much of the cost of any gasoline plant is in heat-transfer equipment and there are many opportunities for economy in design of this type of equipment.

Removable shell cover . . . Some specifications require that the heat exchangers be of the pull-through bundle type; that is, the tube bundle can be removed without removing the floating head cover. This has certain advantages particularly in the testing of the bundle after repair. If the bundle can be removed without removing the floating head cover, it would seem to be an unnecessary extravagance to include in the specifications that the required unit also include a useless removable shell cover.

Oversurface . . . It is not uncommon to find in the specifications, the requirement that a heat exchanger must include a certain percentage of oversurface—sometimes as high as 50% above the surface calculated from the actual rating. This is sometimes done in anticipation of an increase in inlet temperatures rather than an increase in quantity. The results obtained when the temperature is actually increased can be quite disappointing since the increased surface may have decreased the fluid velocity and corresponding transfer rate to the point where little additional benefit is gained. If oversurface is specified in anticipation of future increased temperature, it should be so stated in the specifications. The additional surface can then be provided in the form of longer tubes, thus avoiding a reduction in fluid velocity.

TABLE 1—INDUSTRY SPECIFICATIONS, STANDARDS, OR CODES

Pressure Vessels
Section VIII ASME Boiler and Pressure Vessel Code, Latest Revision.

Heat Exchangers.
Section VIII ASME Boiler and Pressure Vessel Code, Latest Revision.
Standards of Tubular Exchanger Manufacturers Association.

Pumps
API Specifications Standard 610.

Boilers
Section I ASME Boiler and Pressure Code, Latest Revision.

Buildings
American Institute of Steel Construction Specifications.
National Bureau Standards Bulletin A-58.1.

Piping
American Standard Code for Pressure Piping (ASA B31.1, Latest Rev.)

Motors
National Electrical Manufacturers Association Standards.
American Institute of Electrical Engineers Standards.
National Electrical Code Requirements.

Structural and Concrete
American Institute of Steel Construction "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings."
American Concrete Institute Building Code, Requirements for Reinforced Concrete ACI 318-56.

Electrical Materials
National Electrical Manufacturers Association Standards.
National Electrical Code Requirements.

Cooling Towers
Cooling Tower Institute Codes and Standards for Cooling Towers.

Thermal and physical data . . . Many heat exchangers are oversized at unnecessary expense because the heat-exchanger manufacturer has been supplied with inadequate thermal or physical data. Data such as characterization factors of the fluid, viscosity, condensing curves, and heat-release curves can be of tremendous assistance in accurately sizing heat exchangers. In the absence of this information, the heat-exchanger manufacturer can only be ultraconservative and add additional surface which may not be needed.

Tube length and pitch . . . Arbitrary specifications governing tube length and pitch can often result in unnecessarily expensive heat-exchange equipment. Many specifications limit tube length to 192 in. Careful consideration should be given to the use of longer tubes since the use of these tubes might reduce the shell diameter and materially reduce the cost. Square pitch is sometimes specified to provide for easier cleaning. We do occasionally find square pitch specified in perfectly clean services where triangular pitch would be equally satisfactory and less expensive.

Tube diameter . . . The heat-exchanger specifications frequently set the tube diameter—usually ¾ in. If the sole purpose of the requirement is to prevent the use of smaller tubes, it should so state or specify as ¾ in. **minimum.** There are frequently no objections to the use of larger tubes, and pressure-drop factors may make the incorporation of larger tubes a more economical design. The specification of pressure drops should be realistic. An ultraconservative estimate of pressure drops may lead to unjustified increases in the size of an exchanger. Where two or more services of an exchanger are in series, such as a lean oil-rich oil exchanger and a lean-oil cooler, it is best to specify the permissible over-all pressure drop for the combined units. Allowing the heat-exchanger manufacturer more latitude in the distribution of pressure drop frequently results in a more economical design.

What code? . . . Careful consideration should be given to the specification of the code under which the heat exchangers are manufactured, partic-

When to start field construction?

Another opportunity for saving in plant cost is in the proper timing for the starting of field construction. After a contract has been let, there is a very human and understandable tendency on the part of the client to want to see something happening. He wants to see some dirt being moved at the plant and the contractor is very frequently under pressure to begin field work before the economic optimum time.

It has been our experience that most field construction is started too soon. In practically every instance, the final completion date of the plant is determined by the receipt of equipment. If field construction is started too soon, and is slowed down by the necessity of waiting for the arrival of critical pieces of equipment, it cannot help but result in increased labor costs. Men are kept on the payroll pending the arrival of equipment and are not used to their fullest capacity. Parts of the project are started and discontinued to be resumed later. This piecemeal type of construction always results in a certain amount of waste and increased cost.

ularly if they should be fabricated in accordance with the Codes TEMA C or TEMA R. The latter has been designed primarily for refinery service, and incorporates some expensive construction which may not be justified in natural-gasoline-plant service. There are several minor differences in the specifications but the major difference is in the corrosion allowance and flange construction. TEMA R requires ⅛-in. corrosion allowance and the use of butt-welding flanges. TEMA C requires ¼-in. corrosion allowance and permits the use of slipon or builtup flanges. The latter may be entirely satisfactory for gasoline-plant service.

The corrosion allowances mentioned above are used only where no specific allowance is included in the specifications. As in the case of pressure vessels, due consideration should be taken of the actual corrosion conditions. In services where no corrosion is anticipated, some saving in the fabrication may be obtained by the omission of the corrosion allowance from either the TEMA C or TEMA R specifications.

4—Heaters

The specifications for heaters are usually not as elaborate as those included for other types of equipment, but even here some specifications can increase the expense of a heater without any great benefits.

Return bends . . . The practice of using plug-type return bends on rich-oil heaters is not general, but there are still some specifications which require their use on every tube. Their use increases the cost of the heater considerably and can be not only of doubtful benefit but can sometimes be a liability since they are occasionally a source of oil leakage.

Refractories . . . The specification of definite types of refractories may conform to the standards of one heater manufacturer and penalize others. For example, the specification of suspended arch refractories would prevent the use of castable refractories which in many instances are entirely satisfactory and more economical. It is quite common practice to specify a maximum permissible heat flux to be used in a heater. This does not always accomplish the basic intent and sometimes results in a more expensive heater than is necessary.

The thing that we are trying to accomplish is to limit the tube-wall temperature. In the case of thermally sensitive fluids, such as hydrocarbons, this is to prevent undesirable decomposition or coking. Or in some services, it is merely to prevent the destruction of the tube itself due to overheating.

Heat flux . . . A direct-fired heater is a form of heat exchanger and is subject to the same basic principles as other heat exchangers. The heat flux is a function of the difference in temperature between the tube wall and the flowing fluid and the inside film-transfer rate. If the inside transfer rate is high, a high heat flux can be maintained without producing excessive tube-wall temperature. In services having a low heat-transfer rate, the heat flux must be kept correspondingly low. Might it not be better to specify the tube-wall temperature which is the basic requirement and can even be measured rather than the heat flux in which we are only indirectly interested and can be measured only indirectly?

5—Boilers

The specifications governing steam boilers are often overly elaborate and may result in an unnecessarily expensive boiler.

Large-diameter tubes? . . . There may be instances when large-diameter boiler tubes are quite essential for satisfactory boiler operation, but these instances are comparatively rare. Modern tube cleaners and modern water treatment have made large tubes unnecessary except where special circulation problems are encountered. For the same steam load, large-diameter tubes result in larger boilers.

Drum diameters . . . Modern boiler furnaces are also capable of higher heat releases than the older types. This has been brought about by an improvement in the combustion characteristics of the boiler and the use of large water wall areas which effectively limit furnace temperatures in spite of high heat releases. The specification of large drum diameters can substantially increase the cost of a boiler without necessarily increasing the steam releasing area. The specification of a large-diameter drum adds cost to the boiler not only because of the increased cost of the drum itself, but of the special engineering which may be required to lay out drum and tube pattern.

6—Buildings

The basis of design of buildings is adequately provided in the specifications of the American Institute of Steel Construction and the National Bureau of Standards Bulletin A-58.1, the latter providing the necessary design information on wind and snow loads. There is a common tendency to prepare general building specifications which will be used without regard to local conditions.

Minimum thickness . . . The specification of minimum thicknesses of structural members can be overly conservative. One-fourth-inch minimum was once a part of AISC specifications. These specifications have been revised to eliminate a minimum on any inside steel structure, and minimum thickness on the outside has been limited to $\frac{1}{16}$ in. The old ¼-in. minimum is still prevalent in many specifications. Some specifications have included additional thickness on structural members for corrosion allowance. This is an expensive practice. Protective coatings, such as paint or galvanizing, are more economical.

Building specifications have frequently failed to take into consideration the availability of new materials. The 26-page high-tensile, deep corrugated sheet commonly used today is structurally superior to the 20-gage mild-steel corrugated sheet formerly used.

"Economical" . . . In the selection of structural sections for buildings as well as other steel structures, the strength requirements are calculated and sections selected from a steel handbook as the most "economical." Economical means in this case a section requiring the least amount of steel which will satisfy the strength requirement. Unfortunately, these selections may not be the most economical in the true sense of the word since many sections listed in steel handbooks require special rolling for which a premium price is charged. It is suggested that the steel fabricator be allowed some latitude in the selection of sections since he is usually familiar with those sections which are commercially available.

Industry Codes

We have reviewed only a relatively few specifications which we believe might be omitted or modified in the interest of economy. In general, it would seem wise to utilize the existing industry codes and specifications wherever these are available and applicable. These specifications have usually been jointly prepared by representatives of both manufacturer and user of equipment and consequently, contain the best ideas of both. Furthermore, the committees responsible for these codes are usually quite active in keeping them up-to-date and consistent with technological advances. This, unfortunately, is not always true of the specifications prepared by individual companies. In Table 1, we have listed the various categories of equipment together with the corresponding standards or codes which are applicable to that particular category.

What Is Design Capacity?

Now that we have discussed general specifications, let us get down to the specifications of a specific plant we have under consideration. What should the design capacity of the plant be? If we know the maximum future gas flow, it is easy to say that this should be the design capacity. But should it? How often will the plant reach this maximum capacity? If the occasions are rare, perhaps it might be best to bypass a portion of the gas during this short peak load, or include sufficient overcapacity in the absorbers only.

Guaranteed recoveries . . . Usually in the early stages of development of a plant project, considerable thought and study are given to determining the optimum percentage of products, particularly propane, to be recovered. This percentage of recovery usually becomes a part of the contractor's guarantee. In this connection, it is suggested that careful consideration be given to year-round weather conditions and an ambient temperature be selected at which the guaranteed recoveries must be obtained. It is doubtful if a plant designed to meet guaranteed recoveries at maximum ambient - temperature conditions can be economically justified.

We believe that it would be helpful in preventing overdesign if each inquiry contained two temperatures, the lower one being that at which the plant should meet the guarantee of recovery and the higher temperature being that below which the plant should operate smoothly.

A fractionating column that is designed to operate at total condensation must do so regardless of the weather, but it may be very difficult to justify a lean-oil cooler large enough to maintain an oil temperature such that the design percentage of propane may be recovered on the hottest day in the year.

How about standby equipment? . . . Again it is easy to say that every pump should have a standby unit. It is doubtful if this can always be justified. The modern centrifugal pump has such an excellent service that there are times that the loss of product which occurs during the time that these units are out of service is so small that it cannot pay for a standby unit within the life of the plant. This applies particularly to more expensive pumps such as the high-pressure lean-oil pumps.

In deciding whether to spare or not to spare, there are often other factors which must be considered. There is of course the case where contractual obligations require that the plant be kept to full operation regardless of any economic consideration. When a plant treating pipeline gas is shut down, the product not recovered during the shutdown is forever lost. This is not true in the case of a cycling plant where the products remain intact in the reservoir until the plant is ready to operate again.

Cost-Plus or Turnkey?

In preparing an inquiry to be sent to the contractor, the inevitable question of the type of contract arises—should it be a cost-plus, or a turnkey, or some intermediate type? We believe that the turnkey contract offers a source of saving to a prospective plant owner. If we assume that the prospective plant owner will require the contractor to furnish a definite performance guarantee, a tendency toward overdesign on the part of the owner by adding here and there to the capacity of equipment is considerably reduced if the contractor is bound by a turnkey contract.

For the purpose of preliminary estimates and economic studies, it is usually necessary for the prospective plant owner to do a certain amount of process design. We believe, however, that the wise owner will request each contractor to submit his bid on the basis of a process offered by contractor. We realize that this tremendously complicates the problem of bid evaluation, but it does enable the prospective owner to take advantage of the ingenuity and experience of the contractor in effecting economy in design.

In order to take full advantages of the services which a competent contractor may render, the contractor should be given considerable latitude in the selection of mechanical equipment as well as process design since the economics of the two can be very closely tied together. For example, the places in the plant where air cooling may be most economically used, and places where water is best are closely related to the process.

It is also extremely important that the contractor be supplied with a definite basis for the capitalization of various utilities and operating costs. This should include capitalization values of electric power, if purchased, water, fuel, shrinkage and particularly operating labor. This latter item is important since a competent contractor will be conscious of labor costs in the selection and grouping of equipment and also the degree to which automatic control can be justified.

Plant thermal efficiency is important in any cost-cutting program

Other items that will pay dividends for careful scouting are: selection and rating of mechanical equipment, application of authentic controls, and increased recovery.

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TODAY there is a continued pinch on plant profits. The plant owner or operator must be especially alert and realistic in the month-to-month reappraisal of the many factors that influence over-all economics.

This is especially true in the case of the older plants which have been fully depreciated and which, in most cases, were designed for relatively low propane recovery. But opportunities for cost cutting exist in new plants also.

Plant thermal efficiency often can be raised by attention to: (1) fractionating column reflux ratios, (2) reboiler heating surface, (3) column operating pressure, (4) excessive use of steam turbine drive, and (5) sizing oil-to-oil heat exchangers.

Other items that bear careful scouting are: Selection and rating of mechanical equipment, application of automatic controls, and increased recovery.

In most cases, plant owners are limited in operating flexibility by factors which are inherent with the original design, such as working pressure and size of vessels, size of heat exchangers, cooling units, interconnecting piping, pumps, motors, etc. Although some of these facilities can be supplemented economically by similar parallel units, in many instances the cost is prohibitive. Plant operating and modification problems are almost infinite in number. It is not the purpose of this paper to suggest magic panaceas but rather to discuss some approaches to the problems which may be considered in an effort to realize maximum return on capital invested.

Plant Thermal Efficiency

It has been the writer's experience that over-all thermal efficiency is often low in the older plants and even in some of the relatively new plants.

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Fractionating column reflux ratios . . . These are often higher than necessary. Of course the operator on tour wants the unit to perform with as little attention as possible so his tendency is to use an excessive amount of reflux. This stems from the fact that increasing the quantity of reflux to a column is sometimes considered to be a "cure all" and indeed this is not surprising since perhaps no other single factor affects the operation in so many different ways. To mention some of these, increasing the reflux ratio accomplishes closer separation between the distillate and the bottom product under most all conditions assuming, of course, that the column flood point has not been exceeded and that reboiler heating surface is adequate.

It will correct cases in which high feed vaporization results in an excessive amount of the heavy key component being carried overhead. It smoothes out operation with widely varying feed composition and rate. Small wonder then that the tendency of the operator is to use high reflux ratios and **"let the plant run"** rather than expend energy by operating intelligently. Further, more often than might be expected, product purities are **actually higher** than necessary to meet market demands.

Reboiler heating surface . . . In some instances there is inadequate reboiler heating surface, and therefore a need for excessive feed heat input and resulting vaporization. The operator is then compelled to use an unusually large amount of reflux. In such cases the payout for installing a new reboiler is nearly always attractive. In connection with the foregoing discussion it is well to remember that reflux quantity is essentially the controlling factor governing heat input and waste heat to be dissipated in the cooling tower.

Column operating pressure . . . Due to improper fractionating sequence or to excessive pressure drop across reflux condensers, columns must many times be operated at higher than normal pressures in order to obtain total condensation of the net overhead products. Such a condition contributes its share to the need for a large amount of reflux and, of course, heat input. Generally speaking, the optimum operating pressure for any fractionating column may be thought of in two ways. It may be that pressure (at available cooling-water temperature) which results in reaching the dew point of the net overhead product in columns that are not designed to operate totally condensing. Or it may be the pressure which results in total condensation of the overhead product for those units which **are** designed to operate in this manner.

Using steam-turbine drive . . . A perennial offender from the standpoint of thermal efficiency, especially in the older plants, is the indiscriminate use of steam turbines for driving centrifugal pumps. If at all possible, pumping services selected for turbine drive should be such that most of the exhaust steam can be used for process heating or for still stripping.

By judicious rearrangement of individual turbine-driven pumps as multipump units, that is, three or four pumps powered by a single steam turbine exhausting at 75 to 100 psig., the selected loads can be such that the turbine water rate will satisfy certain process heat duties. This presupposes, of course, that live steam is available at a minimum pressure of 250 psig.

It is well to point out that turbines become specially constructed units when the exhaust pressure ex-

ceeds 75 psig. On the more favorable side, however, it should be remembered that integrally mounted speed reducers permit wide latitude in the selection of pump speeds thus allowing the turbine to operate at the highest practicable speed for control of water rate.

Sizing oil-to-oil heat exchangers . . . Another flagrant offender which contributes to low thermal efficiency is the improper application and sizing of oil-to-oil heat exchangers. A case in point, important because of the magnitude of heat involved, would be the supply of heat to a rich-oil stabilizer. This is especially important when it is necessary that a high percentage or perhaps all of the heat be furnished at the bottom of the column. When this is the case it is often difficult to obtain economical heat-exchanger mean temperature differences without dissipating a substantial amount of heat in the cooling tower.

All heat losses are, of course, double offenders in that heat is not only unavailable for useful purposes but requires added investment in cooling tower and heat-exchange equipment for final dissipation. When the bottom temperature of a rich-oil stabilizer is in the range 250° to 350° F. loss of heat can often be avoided by generating still stripping steam with the lean oil from the still prior to supplying rich oil stabilizer bottoms heat. Under some conditions it is practicable to effect additional savings by supplying a limited amount of the heat intertray between the feed and the bottom, in the feed itself or at both points.

Fractionating columns requiring either high or low level heat for reboiler or feed preheat duty often afford excellent opportunities for increased thermal efficiency by incorporating them properly in the lean oil cycle.

Perhaps less important but also contributing to low thermal efficiency is the failure to insulate oil-to-oil heat exchangers, feed heat exchangers, etc. Though fundamentally unsound the thinking back of this practice is that it is only important to cool the medium giving up the heat. The same fallacious reasoning often prompts the plant owner to specify that the medium giving up heat be delivered through the shell side of the heat exchanger when economical design might favor the tube side.

Selection and Rating—Mechanical Equipment

At the inception of any gasoline-plant venture it is recognized that although certain gas volumes, available pressures, rates of production, and liquid-product contents must be assumed for design purposes, any one or perhaps all of these factors may and often do vary quite widely over a month's operation period. Indeed, some of them vary from day to day depending upon the field producing methods, type of producing reservoir, gas-oil ratios, etc. Gas produced from some reservoirs grows successively richer as the oil field depletes. In others it may get richer for a period then successively leaner. Still in others the gas may start out relatively rich and be very lean by the time the field is to be abandoned.

This is especially true in the case of cycling or pressure-maintenance plants, since in both instances, when liquid hydrocarbons have been depleted, the remaining reservoir space is filled mainly with dry gas. The foregoing facts point up the importance of selecting mechanical equipment which can be easily adjusted or adapted to the constantly changing operating loads and liquid-product contents of the gas.

"On the safe side" . . . The tendency of plant designers to be "on the safe side" in rating mechanical units contributes substantially to reduced plant efficiency. Centrifugal pumps in particular are almost invariably specified for greater heads than are required, causing the unit to operate at low efficiency and sometimes resulting in driver overloads. This situation becomes more acute as the plant gas load declines and the natural tendency is for **all** loads to be reduced. The condition can often be corrected by trimming pump impellers to the proper size.

Compressor cylinder size . . . It is surprising how often compressor cylinder sizes are specified with little or no consideration given to future conditions. Of course, the prudent operator normally specifies that cylinders be adequately sized and equipped with necessary clearance arrangements and valve lifters so that they may be operated efficiently under the widely varying conditions anticipated during the life of the plant.

Further, his position is such that when gas volumes have declined, some of the units can be shut down and moved to new locations. But each plant faced with a declining gas load has its particular economic outlook. In many cases, where cylinders were improperly sized originally, it was profitable to purchase larger cylinders so that the required number of machines could be loaded, thus reducing operating and maintenance costs and releasing the remaining units for service elsewhere.

Gas-engine drive . . . In some of the medium-size and in many of the smaller plants it is often uneconomical to install sufficient electric generator capacity to handle the heavier pumping duties such as cooling-tower water and engine-jacket-water loads. Although the medium-size industrial-type multicylinder gas engines are considered by many engineers to be poor substitutes for electric motors or steam turbines, there are several rugged units on the market which will give years of trouble-free low-maintenance-cost service, if properly rated for the specific duty. For 24-hour service the engine should be rated at 55 to 60 lb. b.m.e.p. at a maximum speed of 1,000 r.p.m.

Hydraulic motors . . . Another good

Tips on raising thermal efficiency

1. **Watch column reflux ratios.** Beware of operator tending to use high reflux ratios and "let the plan run" rather than to expend energy by operating intelligently.
2. **More reboiler heating surface.** If this is inadequate there's need for excessive feed input and resulting vaporization.
3. **Rearrange steam-turbine-drive loads.** Pumping services for turbine drive should be such that most of the exhaust steam can be used for process heating or still stripping.
4. **Watch sizing of oil-to-oil exchangers.** Improper application is a flagrant offender which contributes to low efficiency.
5. **Insulate oil-to-oil and feed heat exchangers.** It is fallacious reasoning to think that it is important only to cool the medium giving up the heat.

substitute for electric motors, especially for isolated booster stations or in plants where the electrical load is a problem, is the application of hydraulic motors to drive the fans on aerial-type engine-jacket water and lubricating-oil cooling units. The pumps which handle the oil to power the hydraulic motors can be directly connected to the compressor by stub shaft arrangement at the flywheel. The system is simple and trouble-free if properly installed. It is particularly important that the oil used in the hydraulic system be thoroughly filtered and the piping system be flushed clean prior to startup. This is due to the close tolerances employed in pump and hydraulic-motor design.

Operating Personnel

Automatic control techniques are progressing rapidly with the many fine instruments currently available or in the process of being developed. The potentials for application of automatic controls are so numerous and varied that no attempt will be made to discuss plant services which may be considered in a modification program. Generally speaking, however, any job which can be done automatically can be accomplished more efficiently, more economically, and with greater safety than the same job handled manually.

Good examples of tangible savings accruing as a result of increased use of automatic controls are the many plants now operating with one or two men on tour whereas others, comparable in size, but with fewer automatic features are using two to four men to accomplish the same results.

Increased Recovery

With increased market demand for propane, plant owners are investigating various modification and expansion schemes in an effort to justify expenditures for increased recovery. With absorbers operating at maximum permissible pressure it is sometimes expedient to increase the lean-oil rate or refrigerate the oil or both and more often than not the gas load has been sustained or perhaps increased due to additional drilling and field expansion.

In most of these cases excellent results can be obtained by replacing conventional bubble trays with one of the makes of new high-capacity, high-efficiency trays. Thus both capacity and absorption efficiency can be substantially increased with relatively small additional investment. However, it should be remembered that increased absorption is only the first step toward increased recovery since economical elimination of the methane and ethane unavoidably absorbed must be accomplished either prior to or after stripping of the rich oil.

Deethanization . . . If the inlet gas is sufficiently rich (2.0 to 3.0 gal. per M.c.f. of recoverable propane and heavier) and the primary absorption pressure is in the range 500 to 1,000 psig., at least partial elimination of the methane and ethane prior to distillation usually produces very satisfying results. Of course, if the gas is rich enough, complete deethanization of the rich oil is normally a rewarding modification for effecting increased propane recovery in older plants which have as much as 10 years remaining gas reserves available for processing.

Requirements for new equipment necessarily vary widely from plant to plant depending principally on the working pressures and sizes of the existing vessels. It has been the writer's experience that more often than might be expected some of the vessels in a plant to be modified can be used. For example, small absorbers or reabsorbers on hand can, if the working pressure of the shell is suitable, sometimes be retrayed with one of the modern high-capacity trays and used for the reabsorption section of a rich-oil stabilizer. The same can be done with a larger vessel for the stripping section.

In such cases, it is normally cheaper to allow both vessels to rest on foundations and pump rich oil from the bottom of the reabsorption section to the feed tray of the stripping section, rather than convert the two vessels into a single column by connecting them with a swaged section. In several cases involving rich-oil deethanization, the author has used an existing product deethanizer for the reabsorption section and the column loading was such that retraying was not required. The foregoing arrangement accomplishes very satisfactory results with a minimum investment in new facilities.

The heat required in the process is such that the existing oil-to-oil heat exchanges can often be rearranged and supplemented to accomplish the desired results. The still operates totally condensing at about 100 psig., and in most cases the pressure on the rich-oil deethanizer is sufficient to deliver the conditioned rich oil through a direct-fired heater and into the still for stripping. The still overhead product can then be fed directly to a depropanizer and thence through any fractionating columns required to satisfy product specifications for market demand. With the foregoing arrangement the recompressor and product deethanizer are eliminated.

More on Fractionation

Any discussion covering means of increasing product recoveries would be incomplete without touching further on the subject of fractionation. In discussing plant thermal efficiency, earlier in this paper, the need for "over refluxing" a fractionating column as a result of excessive feed vaporization was mentioned. Nevertheless, in some cases the feed enters the column at a temperature below the bubble point. If so, it is important that the condition be recognized in case additional column capacity is required in a modification or expansion program.

It has been experienced that under most operating conditions the bottom tray load on fractionating columns is controlling due to the heat supplied at that point. Therefore, the proper amount of heat supplied in the feed is often very important in that a substantial increase in column loading and fractionating efficiency can be accomplished by vaporizing some of the feed, thus relieving both liquid and vapor load on the bottom tray. A workable rule to follow is to limit the per cent of feed vaporized to the per cent of feed taken overhead as product. Beyond this point no appreciable vapor or liquid unloading of the bottom tray occurs and reflux requirements and total heat input increase rather sharply.

It seems to be the rule rather than the exception that in plants where no particular effort has been made to eliminate at least some of the methane from the raw product prior to deethanization the product deethanizer column operates as a "glorified" flash tower in that liquid reflux is seldom obtained. Actually the reflux pump is often found to be handling a vapor-liquid mixture with vapor predominating. This condition contributes, of course, to loss of propane in the overhead gas.

A nominal amount of refrigeration of the overhead material will in most cases obtain good results especially where cooling-water temperatures are unavoidably high. Thus liquid reflux is obtainable both winter and summer and propane recovery increased. A small stream of glycol must be injected into the overhead material of the chiller, if the raw product has not been dehydrated, to obviate the formation of hydrates. The glycol system is small and regeneration is simple and inexpensive.

Journal Field-Processing Survey Shows . . .

Little change in number or capacity of nation's plants

IN THIS YEAR'S survey of field processing plants, an extra breakdown of liquid products has been included to afford a better and more accurate picture of operations. Production of liquids heavier than natural gasoline is shown for the first time.

It should be noted that the column showing figures for combined natural gasoline and LPG stream includes **only** combined streams which are marketed without being separated. The column showing liquids heavier than natural gasoline includes only products marketed as a separate stream.

The Journal survey shows no major changes in the field processing picture in the United States. However, two new provinces in Canada have joined Alberta this year in field-processing operations. They are British Columbia and Saskatchewan, each with one plant.

Amount of construction planned or under way shows no significant change in pace from that reported last year in the survey.

Recap of U. S. Natural-Gasoline Plants, as of January '58

State—	No. plants	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day): Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
Arkansas	7	169.1	70.4	5,200	98,397	79,119	1,579
California	66	1,801.5	1,211.8	1,042,980	873,910	1,275,256	.....
Colorado	11	164.6	142.1	59,238	182,442	76,092	.....
Illinois	6	627	488.8	.....	739,600	76,150	.....
Kansas	14	1,857.4	1,104.9	88,340	280,369	252,373	.....
Kentucky	5	1,125.7	1,027.2	9,000	404,500	84,100	.....
Louisiana	35	2,198	1,643.1	197,215	699,865	512,274	150,998
Michigan	1	15	4	10,000	.....	.....	.....
Mississippi	1	50	38	.....	8,000	12,000	.....
Montana	2	60	38	50,000	22,000	15,000	.....
Nebraska	4	69.5	29.1	.....	108,357	35,676	.....
New Mexico	22	1,906.4	402.2	1,211,479	942,156	755,354	14,416
North Dakota	1	65	45	.....	130,000	26,000	.....
Ohio	1	12	12	2,000	.....	.....	.....
Oklahoma	66	1,630.4	1,295.6	875,393	1,521,161	946,963	.....
Pennsylvania	7	51.5	40	7,111	5,000	2,000	.....
Texas	201	11,232	6,706.3	6,975,284	6,245,637	4,335,435	387,206
Utah	1	22	10	400	.....	.....	.....
West Virginia	28	453	213.9	40,682	143,200	61,700	.....
Wyoming	9	270.5	174.5	43,800	153,800	76,995	.....
Total	488	23,780.6	14,696.9	10,618,122	12,558,394	8,622,487	554,199

Journal Survey of

U. S. Natural-Gasoline Plants

. . . where they are, what they produce, and how much

What the symbols mean . . .

*Gas injection conducted. †Not reported. ‡Figures represent capacity, not production. ¶Figures estimated.

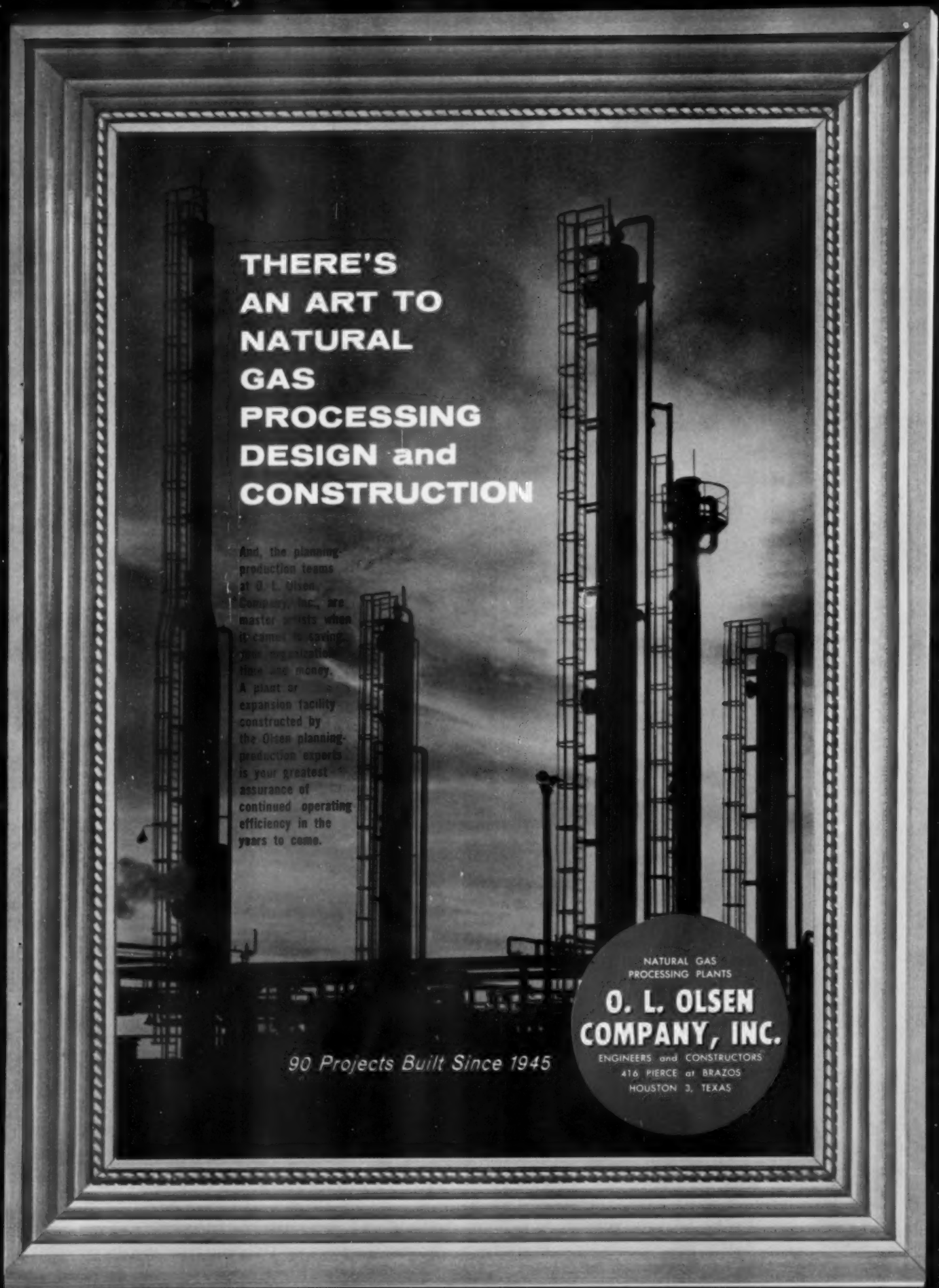
Note: The U. S. survey is made up of two sets of tabulations; one covering natural-gasoline plants, and one covering cycling plants.

Arkansas

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day): Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
Arkansas Louisiana Gas Co.:						
Dorcheat-Macedonia, Columbia (Magnolia)	100	39	.....	47,401	19,170	1,579
Lion Oil Co., Div. Monsanto Chemical Co.:						
Schuler, Union (El Dorado)*	40	14	.....	6,000	7,000	.....
Magnolia Petroleum Co.:						
Kenova, Union (Smackover)	4.1	2.4	.....	2,556	6,725	.....
Querbes, J. R., Oil Co. (vacuum plant):						
South, Union (El Dorado)	5	1	5,200	.....	.....	.....
Shell Oil Co.:						
Magnolia, Columbia (Magnolia)	20	12	.....	28,000	36,000	.....
Sunray Mid-Continent Oil Co.:						
Midway, Lafayette (Hope)	(†)	2	.....	10,353	6,028	.....
Capps, Miller (Rodessa, La.) (formerly Arkla Oil Co.)	(†)	(†)	.....	4,087	4,196	.....
Total	169.1	70.4	5,200	98,397	79,119	1,579

California

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day): Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
Bankline Oil Co.:						
Santa Fe Springs, Los Angeles (Santa Fe Springs)	5	1.5	.....	600	9,000	.....
Midway-Sunset, Kern (Maricopa)	10	5	7,000	.....	.....	.....
Belridge Oil Co.:						
Belridge, Kern (McKittrick)*	80	(†)	.....	.....	.....	.....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NATURAL-GASOLINE-PLANT SURVEY (California continued)

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day) Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
Brea Canyon Oil Co.:						
Brea¶	....	.....	15,000	.....	.....	.....
Coline Gasoline Corp.:						
Rincon-Padre, Ventura (Ventura)	20	13	14,000	32,000	.....	.....
Continental Oil Co.:						
San Miguelito, Ventura (Ventura)*	25	25	.....	22,191	39,778	.....
Cowan Oil & Refining Co.:						
Rosecrans, Los Angeles (Los Angeles)	10	1.3	3,800	.....	.....	.....
General Petroleum Corp.:						
Wilmington, Los Angeles (Wilmington)	50	34.5	174,000	.....	.....	.....
Santa Fe Springs, Los Angeles (Santa Fe Springs)	24	9.5	48,500	.....	.....	.....
Ventura, Ventura (Ventura)	15	6	13,500	.....	.....	.....
Helm, Fresno (Burrel)	25	9	.....	13,000	9,000	.....
Honolulu Oil Corp.:						
Buena Vista Hills, Kern (Taft)	12	12	.....	6,000	18,000	.....
Cymric, Kern (McKittrick) (jointly owned with Standard and Superior)	40	18	.....	23,000	23,000	.....
Inglewood Gasoline Co.:						
Potrero, Los Angeles (Inglewood)	10	7.5	.....	2,000	7,000	.....
Lomita Gasoline Co.:						
Signal Hill, Los Angeles (Long Beach)	40	35	.....	15,000	95,000	.....
Magruder, P. S., Oper., Western-Huffman Gasoline Plants:						
Western, Kings (Avenal)*	65	40	60,449	25,268	35,181	.....
Huffman, Fresno (Avenal)*	50	28	56,331	33,954	22,377	.....
Monterey Oil Co.:						
Huntington Beach, Orange (Huntington Beach)	12	3	.....	3,000	21,200	.....
Rice Ranch Oil Co.:						
Orcutt, Santa Barbara (Santa Maria)	1	0.5	1,500	.....	.....	.....
Richfield Oil Corp.:						
North Coles Levee, Kern (Tupman)*	160	143	113,000	50,000	.....	.....
South Cuyama, Santa Barbara (Cuyama)*	80	73	79,000	42,000	.....	.....
Russell Ranch, San Luis Obispo (Cuyama)*	18	18	.....	21,000	25,000	.....
East Los Angeles, Los Angeles (Los Angeles)	4	3	3,000	.....	.....	.....
Shell Oil Co.:						
Brea, Orange (Brea)	25	12	56,000	.....	.....	.....

(California continued)

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day) Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
Capitan-Santa Maria, Santa Barbara (Santa Barbara)	(†)	1.4	.....	150	2,500	.....
Long Beach, Los Angeles (Long Beach)	(†)	4.6	35,000	.....	.....	.....
Ten Section, Kern (Bakersfield)	(†)	26	.....	55,000	26,000	.....
Ventura, Ventura (Ventura)	147	108	.....	40,000	256,000	.....
Signal Oil & Gas Co.:						
Signal Hill, Los Angeles (Long Beach)	40	22	.....	13,000	46,000	.....
Ellwood, Santa Barbara (Santa Barbara)	15	3	.....	2,000	4,000	.....
Huntington Beach, Orange (Huntington Beach)	50	35	.....	31,000	109,000	.....
Standard Oil Co. of California, Western Operations, Inc.:						
Huntington Beach, Orange (Huntington Beach)	15	10	.....	6,500	33,000	.....
Inglewood, Los Angeles (Inglewood)	15	10	21,700	.....	.....	.....
Murphy Coyote, Orange (La Habra)*	50	39	.....	13,700	47,700	.....
Santa Fe Springs, Los Angeles (Santa Fe Springs)	5	2	14,600	.....	.....	.....
Seal Beach, Los Angeles (Seal Beach)	22	21	39,600	.....	.....	.....
Torrance, Los Angeles (Torrance)	6	5	9,000	.....	.....	.....
Midway, 1-C, Kern (Taft)*	37	38	.....	8,900	51,000	.....
Midway, 7-D, Kern (Taft)	8	9	16,000	.....	.....	.....
Midway, 29-G, Kern (Taft)	7	8	9,400	.....	.....	.....
Greeley, Kern (Bakersfield)*	25	24	.....	25,300	19,200	.....
Lost Hills, Kern (Bakersfield)	3.5	3	3,000	.....	.....	.....
Mountain View, Kern (Bakersfield)	17	16	20,500	.....	.....	.....
Kettleman North Dome, 11P, Kings (Avenal)*	40	26	32,300	.....	.....	.....
Kettleman North Dome, 3P, Kings (Avenal)	60	40	.....	59,000	15,300	.....
Kettleman North Dome, 33J, Fresno (Avenal)*	40	26	28,800	.....	.....	.....
Northeast Coalinga, Fresno (Coalinga)	40	4	3,000	.....	.....	.....
Colonia Vapor Plant, Ventura (Oxnard)	1	1	4,000	.....	.....	.....
Standard Oil Co. of California, Oper., Naval Petroleum Reserve No. 1:						
Elk Hills, Kern (Tupman)*	4	2	2,500	.....	.....	.....
Sunray Mid-Continent Oil Co.:						
Newhall-Potrero, Los Angeles (Los Angeles)	(†)	49	.....	32,347	18,020	.....

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NATURAL-GASOLINE-PLANT SURVEY (California continued)

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day): Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
Superior Oil Co.:						
Rio Bravo, Kern (Shafter)*	30	(†)	.....	50,000	21,000	.....
Texas Co., The:						
Honor Rancho, Los Angeles (Castaic)*	18	(†)	.....	‡14,000	‡11,000	.....
Santa Fe Springs, Los Angeles (Santa Fe Springs)	12	(†)	.....	‡3,000	‡50,000	.....
Signal Hill, Los Angeles (Signal Hill)	30	(†)	.....	‡9,000	‡65,000	.....
Shiells Canyon, Ventura (Fillmore)	32	(†)	.....	‡30,000	‡30,000	.....
Tidewater Oil Co. (three plants):						
Ventura, Ventura (Ventura)*	75	69	.....	78,000	65,000	.....
Union Oil Co. of California:						
Stearns, Orange (Brea)	25	20	.....	26,000	50,000	.....
Bell, Los Angeles (Santa Fe Springs)	12	8	45,000	.....	.....	.....
Dominguez, Los Angeles (Compton)	18	14	50,000	.....	.....	.....
Rosecrans, Los Angeles (Los Angeles)	9	4	17,000	.....	.....	.....
Playa del Rey, Los Angeles (Venice)	4	4	6,000	.....	.....	.....
Sansinena, Los Angeles (Whittier)*	3	3	8,500	.....	.....	.....
Santa Maria, Santa Barbara (Santa Maria)	35	30	.....	50,000	30,000	.....
Belgian Anticline, Kern (Taft)	3	2	6,000	.....	.....	.....
Del Valle, Los Angeles (Saugus)	32	22	.....	38,000	21,000	.....
West Coast Refining Co.:						
Richfield, Orange (Placentia)	35	5	26,000	.....	.....	.....
Total	1,801.5	1,211.8	1,042,980	873,910	1,275,256	.....

Colorado

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day): Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
California Co., The:						
Rangely, Rio Blanco (Rangely)*	55	55	.....	40,000	38,000	.....
Continental Oil Co.:						
Little Beaver, Washington (Brush)	12	11.1	.....	40,742	25,529	.....
Ginther, Warren & Ginther:						
Yenper, Logan	21	15	.....	40,000	10,000	.....
Padroni, Logan	7.5	7	.....	13,000	2,500	.....
Cliff, Logan	3	1	2,500	.....	.....	.....
Lewis Creek, Logan	5	1.5	5,000	.....	.....	.....
Kansas-Nebraska Natural Gas Co.:						
Julesburg Basin, Logan (Sterling)	4.1	0.5	5,423	.....	.....	.....

(Colorado continued)

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day): Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
Mountain Fuel Supply Co.:						
Hiawatha (Moffat)	15	12	1,115	.....	.....	.....
Powder Wash (Moffat)	15	13	4,200	.....	.....	.....
Pure Oil Co.:						
Adena, Morgan	24	24	36,000	48,700	.....	.....
Russell Engineering Corp.:						
Vallery, Fort Morgan	3	2	5,000	.....	.....	.....
Total	164.6	142.1	59,238	182,442	76,029	.....

Illinois

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day): Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
Carter Oil Co.:						
Loudon, Fayette (St. Elmo)	14	(†)	.....	9,600	2,600	.....
MacDonell Co. of Lima, Inc.:						
Sarah Dee, Crawford (Oblong)	100	(†)	.....	.....	50	.....
National Petro-Chemicals Corp.:						
Tuscola, Douglas	500	485	.....	570,000	26,000	.....
Texas Co., The:						
Hoodville, Hamilton (McLeansboro)	7	(†)	.....	‡63,000	‡14,000	.....
Salem, Marion (Salem)	6	(†)	.....	‡74,000	‡26,000	.....
Warren Petroleum Corp.:						
Plant No. 23 (Crossville)	(†)	3.8	.....	23,000	7,000	.....
Total	627	488.8	.....	739,600	76,150	.....

Kansas

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day): Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
Cities Service Oil Co.:						
Various, Sedgwick (Wichita)	120	95	.....	49,000	53,000	.....
Burrton-Stone, Reno (Burrton)	5	4	.....	5,000	8,000	.....
Colorado Interstate Gas Co.:						
Hugoton, Kearney (Lakin)	215	79	10,340 (12 lb. R.v.p.)	.....	.....	.....
Dunn-Mar Oil & Gas Co.:						
Otis, Rush (Otis)	¶5	¶1.1	.....	¶600	¶3,400	.....
Hugoton Production Co.:						
Hugoton, Grant (Ulysses)	90	66.5	.....	31,000	20,000	.....
Kansas-Nebraska Natural Gas Co., Inc.:						
Hugoton, Kearney (Deerfield)	125	7.3	.....	3,270	10,370	.....
Magnolia Petroleum Co.:						
Hickok, Grant (Ulysses)	134	75.7	.....	19,393	22,057	.....
Spivey, Harper (Attica)	45	33.2	.....	22,660	17,506	.....
Northern Natural Gas Co.:						
Hugoton, Seward (Sublette)	325	217	34,200	.....	.....	.....
Hugoton, Finney (Holcomb)	185	118	13,800	.....	.....	.....

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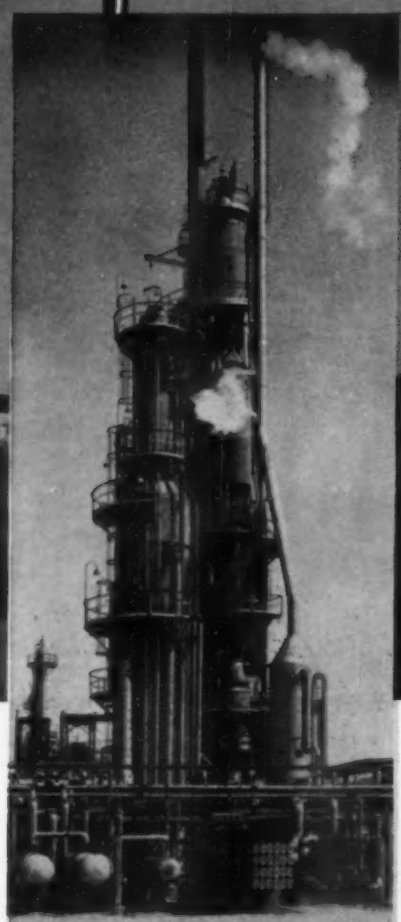

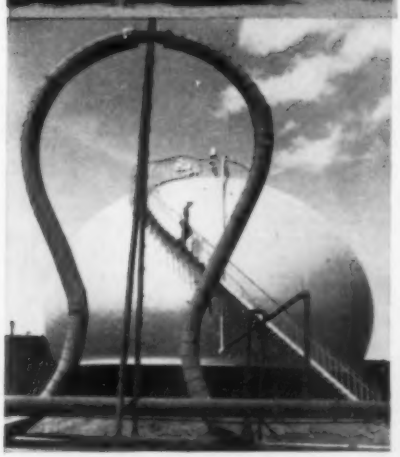

CB&I structures serve two Anderson-Prichard Refineries

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• Above, right: 10-ft. diam. by 38-ft. reactor; 5-ft. stripper and 16-ft. diam. by 49-ft. regenerator were fabricated and erected by CB&I for APCO at Cyril, Oklahoma.

• Top, above: Components for this 4,600-bpd, UOP Catalytic Cracking unit at APCO Arkansas City Refinery were fabricated and erected by CB&I in 1951.

• Above: Hortonspheroid® at Cyril, Oklahoma APCO refinery.

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NATURAL-GASOLINE-PLANT SURVEY (Kansas continued)

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day): Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
Pan American Petroleum Corp.:						
Hugoton, Grant-Stanton-Morton-Stevens (Ulysses)	325	180	.....	105,000	47,000	.....
Panhandle Eastern Pipe Line Co.:						
Hugoton, Seward (Liberal)	240	228.1	.....	40,746	64,740	.....
Skelly Oil Co.:						
Barber County	40	(†)	‡30,000	.....	.....	.....
Texas Co., The:						
Atlanta, Cowley (Burden)*	3.4	(†)	.....	‡3,700	‡6,300	.....
Total	1,857.4	1,104.9	88,340	280,369	252,373	.....

Kentucky

Ashland Oil & Refining Co.:						
Big Sinking Lee (Beattyville)	0.7	0.2	1,000	.....	.....	.....
Kentucky West Virginia Gas Co.:						
Dwale, Floyd	40	35	8,000	.....	.....	.....
Tennessee Gas Transmission Co.:						
Gabe	925	890	.....	365,000	60,000	.....
United Fuel Gas Co.:						
Leach Dryer, Boyd (Catlettsburg)	120	76	.....	‡20,500	‡14,800	.....
Warfield Dryer, Martin (Warfield)	40	26	.....	‡19,000	‡9,300	.....
Total	1,125.7	1,027.2	9,000	404,500	84,100	.....

Louisiana

Amerada Petroleum Corp.:						
Lake Chicot, St. Martins (Baton Rouge)	2.5	1.5	1,975	.....	.....	.....
Leleux, Vermilion (Crowley)	20	9.9	11,800	.....	.....	.....
Anchor Gasoline Corp.:						
Avoyelles, Eola	30.5	27.8	.....	9,180	8,807	.....
Evangeline, Easton	13.5	8.4	.....	4,806	3,331	.....
Acadia, Eunice	27	21.9	.....	10,167	4,715	.....
Point Coupee, East Krotz Springs	25	18	.....	15,000	3,500	.....
Anse LaButte Gasoline Corp.:						
Anse LaButte, St. Martins	10	(†)	5,500	.....	.....	.....
Arkansas Fuel Oil Corp.:						
Homer, Claiborne (Homer)*	0.6	0.6	3,728	.....	.....	.....
Arkansas Louisiana Gas Co.:						
Bistineau-Ada, Webster (Heflin)	60	49	.....	9,003	.....	18,930

(Louisiana continued)

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day): Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
Ruston, Lincoln (Ruston)	50	48	.....	23,205	13,246	31,748
Rodessa, Caddo (Rodessa)	5	4	.....	2,109	5,543	135
Sligo, Bossier (Haughton)	60	42	.....	8,012	.....	14,302
Atlantic Refining Co.:						
Neale, Beauregard (Merryville)	22	16	14,000	10,600	.....	200
Bel Oil Corp.:						
North Elton, Allen (Elton)	35	35	.....	4,000	16,000	.....
California Co., The:						
Hico-Knowles, Lincoln (Ruston)*	75	23	.....	30,000	.....	40,000
Claiborne Gasoline Co.:						
Lisbon, Claiborne (Shreveport)	150	60	.....	27,000	13,000	20,000
Continental Oil Co.:						
Gillis, Calcasieu (Lake Charles)	90	90	89,022	.....	.....	.....
Ville Platte, Evangeline (Ville Platte)*	115	56.1	.....	32,137	50,299	.....
Haynesville Operators Committee:						
Pettit lime*	18	16	.....	3,000	12,000	.....
Humble Oil & Refining Co.:						
St. Landry (Opelousas)	180	170.5	.....	62,820	57,800	.....
Hunt Oil Co.:						
Lisbon, Claiborne (Bernice)	26.9	9.8	.....	7,770	23,352	2,683
Magnolia Petroleum Co.:						
Mamou, Evangeline (Mamou)	7	2.6	.....	4,618	6,524	.....
Hurricane Creek, Beauregard (Longville)	4	4	.....	3,438	8,157	.....
Mississippi River Fuel Corp.:						
Morehouse (Monroe)	300	300	5,500	.....	.....	.....
Runnels Gas Products Corp. and Texas Gas Exploration Co.:						
Various, Acadia (Eunice)	300	300	.....	135,000	55,000	.....
Shell Oil Co.:						
Iowa, Calcasieu (Iowa)	70	49	20,000	.....	.....	.....
Southwest Gas Production Co.:						
Dubach	190	115	.....	115,000	120,000	23,000
Sun Oil Co.:						
Delhi, Richland (Delhi)	17	12	25,000	40,000	.....	.....
Texas Co., The:						
Lafitte, Jefferson (Lafitte)	22	(†)	‡14,000	.....	.....	.....
Paradis, St. Charles (Paradis)	115	(†)	.....	‡70,000	‡36,500	.....
Tidewater Oil Co.:						
Venice, Plaquemines (Venice)	45	42	.....	26,000	9,500	.....
United Gas Pipe Line Co.:						
Sligo-Bisteneau, Bossier-Webster (Haughton)	93.5	90	.....	7,000	45,000	.....
Rodessa, Caddo (Vivian)	16.5	8	.....	40,000	20,000	.....

Congrats and $25 to J. E. ROBERTS, Sohio P. L. Co., 7438 Forsyth, St. Louis, Missouri.

Talk about team work . . . Lone Star Steel's folks always come through with plenty of API quality casing, tubing and line pipe for "coach" Joe Roughneck. Joe, symbolic heart of the oil and gas industry, knows that Lone Star is his dependable source of supply.

The big Lone Star Steel plant is busy 'round the clock . . . and Lone Star API quality is always under complete control from Lone Star-owned ore mines to finished pipe. Fully normalized, of course.

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Good functional design is evident in the compact layout and easy access to equipment which are features of General Petroleum Corporation's new catalytic reformer. The reformer, now in operation at the Ferndale Refinery of this Socony Mobil company, has a capacity of 9000 barrels per day. It is the second unit of its type completed since 1954 in a refinery originally engineered and built by Bechtel as a "grass roots" project.

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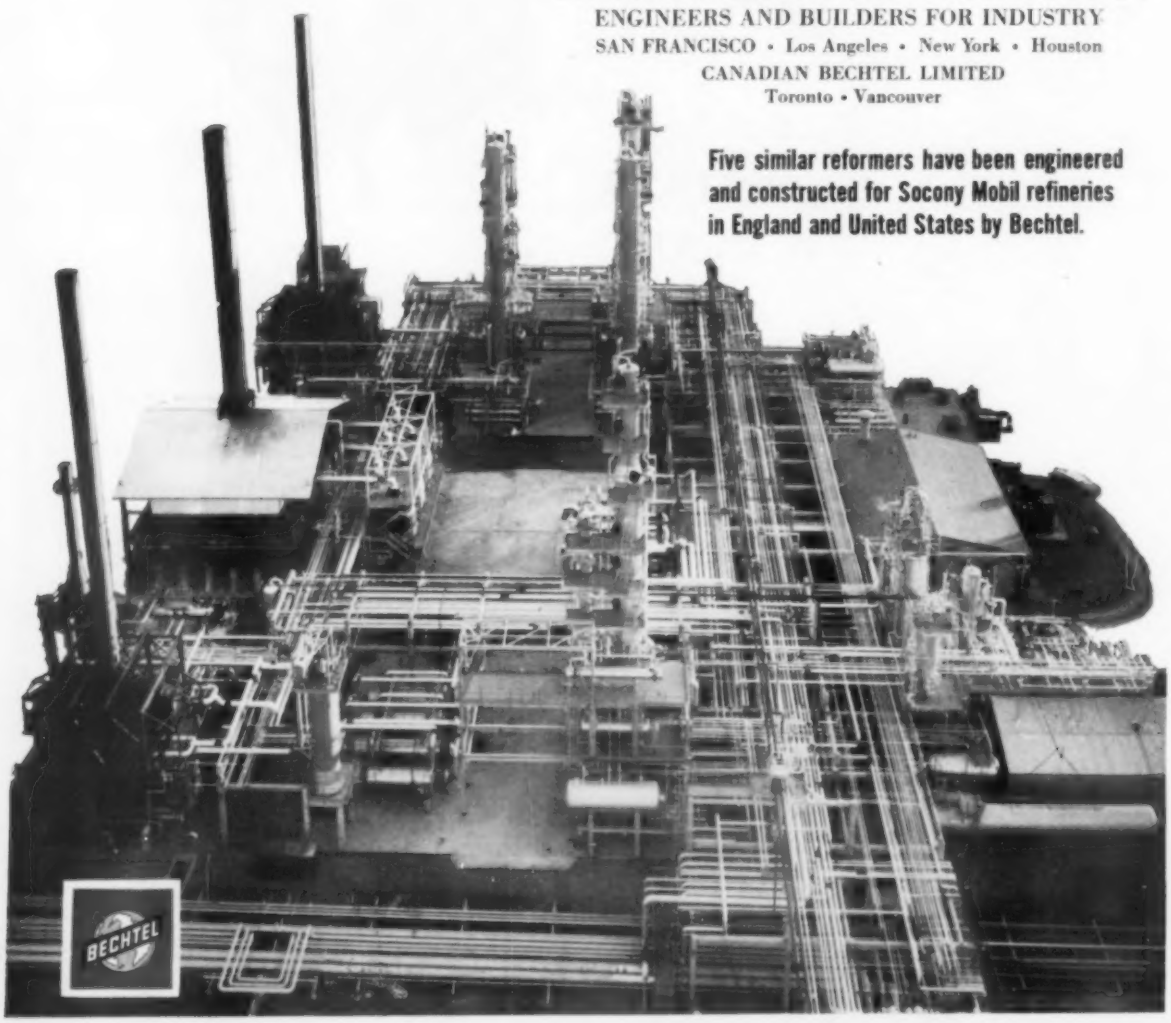
Five similar reformers have been engineered and constructed for Socony Mobil refineries in England and United States by Bechtel.



NATURAL-GASOLINE-PLANT SURVEY (Louisiana continued)

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day): Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
Warren Petroleum Corp.:						
Plant 67, Homer, Claiborne (Homer)*	(†)	12	5,000	.....	.....	.....
Whitton, E. A.:						
Shreveport, Caddo (Shreveport)	2	1	1,690	.....	.....	.....
Total	2,198	1,643.1	197,215	699,865	512,274	150,998

Michigan

Dow Chemical Co.:						
Beaver Creek, Crawford (Grayling)	15	4	10,000	.....	.....	.....

Mississippi

California Co., The:						
Brookhaven, Lincoln (Brookhaven)*	50	38	.....	8,000	12,000	.....

Montana

Texas Natural Gas Corp. and Subsidiaries:						
Glendive plant (Glendive)	(†)	(†)	‡50,000	.....	.....	.....
Union Oil Co. of California:						
Cut Bank, Glacier (Cut Bank)	60	38	.....	22,000	15,000	.....
Total	60	38	50,000	22,000	15,000	.....

Nebraska

Kansas-Nebraska Natural Gas Co., Inc.:						
Duet (Big Springs)	35	5.0	.....	33,245	6,009	.....
Kimball Gas Products Co.:						
Long-Enders-Dietz (Kimball)	9.5	8	.....	41,000	14,000	.....
Ohio Oil Co.:						
Huntsman, Cheyenne (Sidney)	12.5	8.9	.....	20,216	8,962	.....
West Sidney, Cheyenne (Sidney)	12.5	7.2	.....	13,896	6,705	.....
Total	69.5	29.1	.....	108,357	35,676	.....

New Mexico

Atlantic Refining Co.:						
Denton, Lea (Lovington)	28	21	.....	87,300	26,900	1,200
Cabot Carbon Co.:						
King, Lea (Lovington)	3.8	2.5	15,000	.....	.....	.....

(New Mexico continued)

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day): Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
El Paso Natural Gas Co.:						
Jal No. 1, Lea (Jal)	173.9	(†)	.....	13,000	32,000 (26 lb. R.v.p.)	.....
Jal No. 2, Lea (Jal)	47.6	(†)	.....	129,257	119,604 (26 lb. R.v.p.)	.....
Jal No. 3, Lea (Jal)	71.3	(†)	(Remote absorbers only. Rich oil piped to Jal No. 2)			
Jal No. 4, Lea (Jal)	163.7	(†)	.....	56,160	86,400 (26 lb. R.v.p.)	.....
San Juan River, San Juan (Farmington)	91.9	(†)	.....	28,800	25,632 (26 lb. R.v.p.)	.....
Blanco, San Juan (Bloomfield)	634.4	(†)	549,479	(Product stream fractionated at Wingate)		
Wingate, McKinley (Gallup)	.....	.....	.....	287,000	248,000 (26 lb. R.v.p.)	.....
Chaco, San Juan (Farmington)	165	(†)	137,000	(Product stream fractionated at Wingate)		
Frontier Natural Gas Co:						
Grayburg-Jackson, Eddy (Loco Hills)	7	6.5	16,000	16,000	6,000	.....
Maljamar Co-op Repressuring Agreement:						
Maljamar, Lea*	13.8	12.4	.....	8,891	9,311	13,216
Permian Basin Pipeline Co.:						
Lea, Lea (Hobbs)	200	149	.....	31,000	52,100	.....
Phillips Petroleum Co.:						
Eunice, Lea (Oil Center)	82	(†)	‡100,000	.....	.....	.....
Hobbs-Vacuum, Lea (Hobbs)	46	(†)	‡85,000	.....	.....	.....
Skelly Oil Co.:						
Lea	128	(†)	‡285,000	.....	.....	.....
Southern Union Gas Co.:						
Kutz Canyon, San Juan (Bloomfield)	40	35.8	.....	18,748	8,407	.....
Valley Gas Corp.:						
Loco Hills, Eddy (Artesia)*	6	5	.....	10,000	5,000	.....
Anderson Ranch, Lea (Lovington)	4	3	24,000	.....	.....	.....
Warren Petroleum Corp.:						
Plant 18 (Monument)	(†)	76	.....	91,000	46,000	.....
Plant 46 (Saunders)	(†)	36	.....	80,000	45,000	.....
Plant 61, Eunice, Lea (Unice)	(†)	55	.....	85,000	45,000	.....
Total	1,906.4	402.2	1,211,479	942,156	755,354	14,416

North Dakota

Signal Oil & Gas Co.:						
Tioga-Beaver Lodge, Williams (Tioga)	65	45	.....	130,000	26,000	.....

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LUMMUS BUILDING $30-MILLION REFINERY AT WHITEGATE, IRELAND

New 40,000 B/D Installation for Irish Refining Co., Ltd.

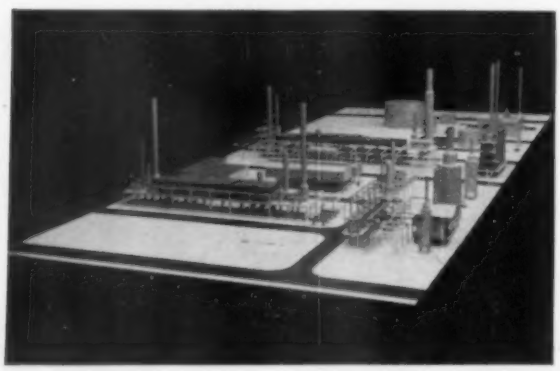
Latest of 19 built by Lummus throughout the world since end of World War II

In the Whitegate area of County Cork, Ireland, a new refinery is now being constructed to meet the increasing demand for oil products.

The refinery is being engineered and built by Lummus for the newly formed Irish Refining Co. Ltd., a joint enterprise of California Texas Corporation, Shell Mex & B.P. Limited and Esso Petroleum Company Limited. As much construction material as possible will be purchased in Ireland, and Irish nationals will be trained to operate the completed plant.

Crude oil distillation facilities will produce jet fuel, diesel oil, fuel oil, light naphtha and other products.

A Powerforming Unit will catalytically reform 9,000 B/D of naphtha to produce 100-octane Powerformate. The unit will include a special hydrofiner to eliminate sulfur compounds from the raw feed stock, and light end facilities. This Powerformer is the only high octane processing unit needed to meet the projected marketing demands.



Model used by Lummus Ltd. in engineering of Whitegate Refinery.

There will also be a gas oil hydrofiner to desulfurize about 6,000 B/D of crude gas oil, the desulfurized products to be used for autodiesel fuel and for blending to form industrial diesel fuel, turbo-jet fuel and tractor vaporizing oil.

Other features will include a copper chloride treating plant for raw gasoline to be blended with regular and premium gasolines, and naphtha to be blended into turbo-jet fuel, regular gasoline and tractor vaporizing oil; facilities for about 10,000 B/D of crude naphtha; and facilities for blending gasolines and adding anti-knock compound. Most of the plant will be air-cooled so that little or no cooling water will be required.

With the completion of this project in 1959, Lummus will be responsible for an impressive percentage of the new refining capacity constructed throughout the world over the past ten years. The experience gained in these projects, as well as in designing and constructing a wide variety of over 700 other plants in the last 50 years for the process industries, is at your disposal. If you have a project in mind, we will be glad to discuss it with you.

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NATURAL-GASOLINE-PLANT SURVEY

Ohio

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day): Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
Ohio Fuel Gas Co.:						
York plant (Medina)	12	12	2,000			

Oklahoma

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day): Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
Apache Gasoline Co.:						
West Brook, Carter (Ardmore)	4	2.5		7,500	5,000	
Boswell-Frates Co.:						
Norfolk, Payne (Cushing)	1.5	1.5	1,000			
Edna, Creek (Bristow)	3	1.5	1,000			
Carter Oil Co.:						
Fitts, Pontotoc (Fittstown)	9	(†)		16,100	7,800	
Cities Service Oil Co.:						
Oklahoma City, Oklahoma (Oklahoma City)	7	5		5,000	6,000	
Hugoton, Texas (Guymon)	(Drip control. Gas processed elsewhere)		8,000			
Various, Kay (Blackwell)	230	200		122,000	56,000	
Continental Oil Co.:						
Short Junction, Cleveland (Oklahoma City)	60	14.9		14,764	9,014	
Dorchester Corp.:						
Guymon-Hugoton, Texas (Hooker)	110	60.8		33,456	15,293	
Eason Oil Co.:						
(Crescent)	14	8.5		15,100	8,000	
Ells, Harry, Inc.:						
Healdton, Carter (Healdton)	3	2		3,500	6,500	
Excelsior Oil Corp.:						
Camrick, Texas (Tyron)	65	3.2		32,880	14,340	
Frame Natural Gasoline Co.:						
Osage (Cleveland)	(†)	(†)	1,500			
Gasoline Plant Management (Operator of Lucien Unit Plant):						
Lucien, Nobel (Perry)	10	7		18,000	8,000	
Garber, Inc. (Sterling Gasoline Plant):						
Spring Valley, Garfield (Garber)	¶15	¶15		¶6,000	¶12,000	
Grimes Gasoline Co.:						
Wetumka, Hughes (Wetumka)	15	10		2,000	4,000	
Grimes & Grimes:						
Weleetka, Okfuskee (Weleetka	15	14		2,500	8,000	

(Oklahoma continued)

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day): Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
Okemah, Okfuskee (Okemah)	1	0.5	1,000			
Otha H. Grimes:						
Pauls Valley, Garvin (Pauls Valley)	5	2.5		6,000	5,000	
Highway Gasoline Co.:						
Middle Peck, Lincoln (Stroud)	5	3		5,000	4,000	
Hugoton Plains Gas & Oil Co.:						
Hugoton, Texas (Tryon)	120	54		14,690	9,538	
Keener Oil Co.:						
Custer (Butler)	35	17		17,000	300	
Kerr-McGee Oil Industries, Inc.:						
Fitts, Pontotoc (Ada)	(†)	2.1		3,800	4,100	
Stroud, Creek (Stroud)	(†)	10		14,000	9,000	
Happy Valley, Lincoln (Cushing)	(†)	5.4		5,000	3,800	
Lone Star Gas Co.:						
Katie, Garvin (Elmore City)	40	25	18,000			
Magnolia Petroleum Co.:						
Graham, Carter (Fox)	17.5	16.1	25,093			
Sholem-Alechem, Stephens (Countyline)	43	28.7		47,539	38,497	
Moran Gasoline Co.:						
Kendrick, Lincoln (Kendrick)	9	8.5		15,000	15,000	
Neal Gasoline Co.:						
Osage	6	2	4,000			
Patoma Hydrocarbon Corp.:						
Marlow, Stephens (Marlow)	25	19		6,000	9,000	
Patton & Swab:						
Edmond, Oklahoma (Edmond)	¶20	¶15	¶20,000			
Phillips Petroleum Co.:						
Burbank, Osage (Shidler)	15	(†)	‡36,000			
Burbank, Osage (Fairfax)	8	(†)	‡30,000			
Edmond, Oklahoma (Edmond)	130	(†)	‡190,000			
Oklahoma City, Oklahoma (Oklahoma City)	16	(†)	‡51,000			
Wewoka, Seminole (Wewoka)	6	(†)	‡16,000			
Edmond, Oklahoma (Edmond)	65	(†)	‡57,000			
Bradley, Garvin (Lindsay)	120	(†)	‡180,000			
Production Properties, Inc.:						
East Washington, McClain (Norman)	10	6		2,000	4,000	
Pure Oil Co.:						
Sapulpa, Creek (Sapulpa)*	4	4	5,400			

Ethyl Research takes a new look at octane improvement costs

Latest Study Aimed At Helping Refiners Cut the Cost of Meeting Road Antiknock Requirements

Gasolines tailored to the same Research octane number specification may behave quite differently from one another in today's high-compression automobile engines on the road.

This complicates the refiner's ever-present problem of how to make the best gasolines, at the least cost.

ETHYL Corporation's Refinery Technologists—working with a leading process-development company—recently completed a study of the road performance of 18 premium-gasoline blends of different compositions. Results of this study are available to refiners as a guide in planning octane-improvement methods that offer a bonus in superior road performance.

1960 Refinery Used as Model

All processes and blending schemes compared were those which might be expected in a 1960 refinery. A series of 18 premium-gasoline blends were made up using the following stocks:

1. Light straightrun naphtha
2. Two isomerized light naphthas
3. Light cat-cracked gasoline
4. Three catalytic reformates
5. Butylene alkylate
6. Propylene alkylate
7. Propylene dimer
8. Propylene polymer

The blends compared in Figures 1 and 2 consisted of 40% C_5-C_6 fraction, 40% C_7 catalytic reformate, 20% butylene alkylate, 3.0 ml tetraethyllead, and enough *n*-butane for a 10 lb. Reid vapor pressure. Various process stocks were used for the C_5-C_6 fraction. The desired Research and road octane numbers were attained by changing severity of reforming.

A 7-octane spread was specified between the road rating of each premium blend and the Research rating of the corresponding regular-grade gasoline. Any cost of the addition of tetraethyllead to the regular grade needed to maintain this spread was charged to the cost of the premium blend in all process comparisons.

Fuels Road-Rated in Engines Designed for the Future

Each of the 18 premium blends was road-rated at two tetraethyllead levels in six test cars. Two of the cars were 1957 models. Of the remaining four, three had compression ratios of 11-to-1, and one had a compression ratio of 12-to-1. This range of compression ratios permitted appraisal of the various processing schemes on the basis of satisfying predicted octane-number requirements of future cars.

Research and Road Octane Costs Compared

In Figures 1 and 2, the costs of producing various premium fuels are compared from a zero level based on the cost of the straightrun-reformate-alkylate blend which rated 99 road octane number. The catalytic-reformate portion of this blend rated 98.9 RON at 3.0 ml tetraethyllead.

The isomerization curves are based on processing pentanes and hexanes from light straightrun naphtha and from light reformate. In one case (Isom I), only *n*-pentane was recycled. In the other (Isom II), total recycle produced isopentane and dimethylbutanes, to-

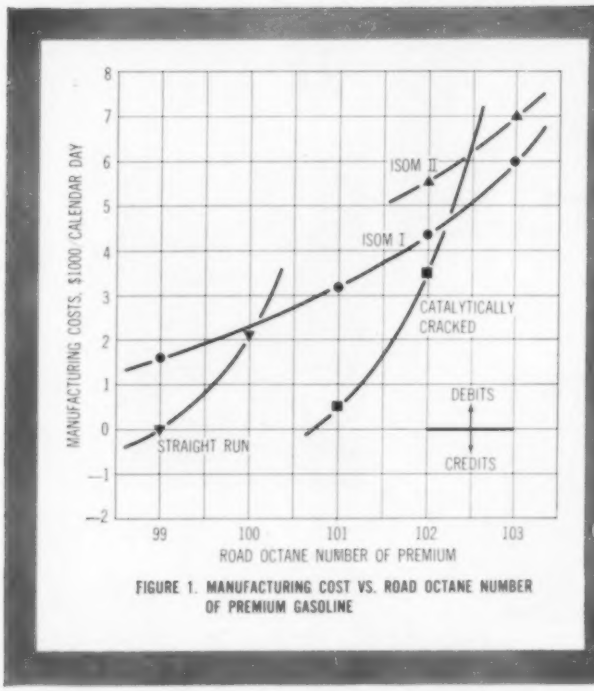


FIGURE 1. MANUFACTURING COST VS. ROAD OCTANE NUMBER OF PREMIUM GASOLINE

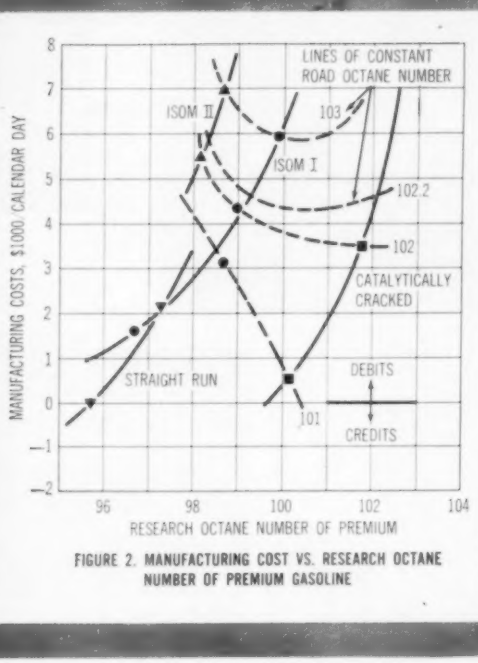


FIGURE 2. MANUFACTURING COST VS. RESEARCH OCTANE NUMBER OF PREMIUM GASOLINE

gether with a minor proportion of methylpentanes and naphthenes.

Choice of Blend Changes Above 102 Road Octane Number

As shown in Figure 1, road performance can be attained at least cost by using a catalytically-cracked C_5-C_6 fraction in premium blends until a road octane number of about 102 is required. Further increases are attained more economically by isomerizing the light straightrun naphtha (Isom I) for blending to premium and diverting the cracked C_5-C_6 fraction to regular-grade gasoline.

At this transition point, calculations from the slopes of the curves indicate that the cost per road octane number barrel is greater than 15 cents with cracked C_5-C_6 fraction in the premium, as compared with about 5 cents using isomerized light straightrun. Beyond this point, Isom I becomes increasingly attractive because it does not require as great increases in reforming severity to attain higher road octane numbers.

Isomerization Improvement Least Costly at High Road Octane Levels

Figure 2 takes both road and Research octane numbers into account. As can be seen, high RON's are obtained at least cost by using a C_5-C_6 fraction from catalytic cracking. However, the lines of constant road octane number show that fuels of the same Research octane rating differ considerably in road performance.

For example, at the 100-RON level, substituting Isom I for light catalytically-cracked stock raises road octane number from 101 to 103.

At a road octane number of 102.2, the two blend types cost the same amount to produce. However, the Research octane number required to satisfy this road requirement is three units lower with Isom I.

Beyond this point, the cost of improving road performance is approximately 7 to 8 cents per Research octane number barrel using isomers, as compared with a cost of 10 to 11 cents using cracked C_5-C_6 fraction.

This study illustrates the importance of analyzing octane-improvement cost on the basis of road antiknock performance rather than laboratory octane numbers alone. Such analysis can improve profits by cutting the cost of meeting actual octane-number requirements on the road.

How Ethyl Research is helping you

Economic studies of octane-improvement processes are a continuing activity of Ethyl's Detroit Research Laboratories.

All of this research is conducted by Ethyl as a service to the Oil Industry—to assist refiners to achieve desired fuel quality and performance at the least possible cost.

The complete report made of this study is available through your Ethyl Representative. Just ask him for a copy of "Road Octane Improvement—A Basis for Process Evaluation."

ETHYL CORPORATION
New York 17, N. Y.

RESEARCH LABORATORIES:
1600 W. Eight Mile Road, Ferndale 20, Mich.
2600 Cajon Road, San Bernardino, Calif.

NATURAL-GASOLINE-PLANT SURVEY (Oklahoma continued)

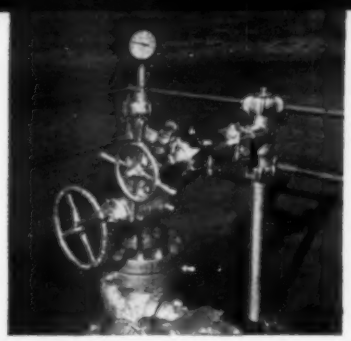
Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day): Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
Service Gas Products Co.:						
Aylesworth, Marshall (Madill)	1.9	0.8	.....	475	1,806	.....
Doyle, Stephens (Marlow)	17	17	.....	8,480	12,438	.....
West Hoover, Garvin (Davis)	7.5	7.5	.....	4,264	6,748	.....
Shell Oil Co.:						
Dillard, Carter (Wilson)	8	5.6	.....	17,000	10,000	.....
Signal Oil & Gas Co.:						
Fox-Milroy, Carter (Healdton)	70	68	.....	90,000	47,000	.....
Sinclair Oil & Gas Co.:						
Plant 2, Cushing, Creek (Drumright)	14	13	.....	27,000	61,000	.....
Plant 6, Garber, Garfield (Covington)	50	25	.....	78,000	48,000	.....
Plant 12, Seminole, Seminole (Seminole)	20	9	.....	45,000	48,000	.....
Plant 13, Seminole, Seminole (Seminole)	15	7	.....	134,000	45,000	.....
Plant 14, St. Louis, Pottawatomie (St. Louis)	14	10	.....	45,000	29,000	.....
Skelly Oil Co.:						
Osage*	9	(†)	‡30,000	.....	.....	.....
Velma, Stephens	70	(†)	‡120,000	.....	.....	.....
Sohio Petroleum Co.:						
West Edmond, Canadian (Edmond)	10	7.2	.....	3,400	2,200	.....
Eola, Garvin (Elmore City)*	35	32	70,000	.....	.....	.....
Sokla Gasoline Co.:						
Fox, Carter (Fox)	(†)	7.3	10,400	.....	.....	.....
Sunray Mid-Continent Oil Co.:						
Moore, Cleveland (Moore)	(†)	18	.....	17,200	8,346	.....
Carney, Lincoln (Chandler)	(†)	8	.....	21,279	9,143	.....
Texas Co., The:						
Davenport, Lincoln (Davenport)	15	.....	.....	‡25,000	‡14,700	.....
Warren Petroleum Corp.:						
Plant 15 (Maud)	(†)	3	.....	7,000	6,000	.....
Plant 22 (Madill)	(†)	11	.....	20,000	13,000	.....
Plant 33 (Maysville)*	(†)	425	.....	505,000	275,000	.....
Plant 60 (Kiefer)*	(†)	15	.....	5,000	25,000	.....
Plant 40 (Ringwood)	(†)	28	.....	30,000	15,000	.....
Plant 57 (Marlow)	(†)	6	.....	1,000	2,000	.....
Wunderlich Development Co.:						
Vernon, Kay (Newkirk)	12	7.5	.....	22,234	5,400	.....
Total	1,630.4	1,295.6	875,393	1,521,161	946,963	.....

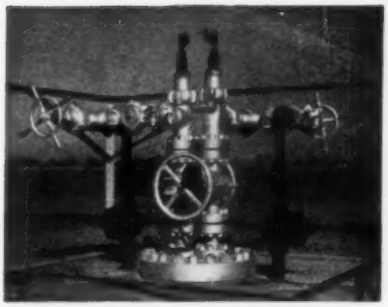
Pennsylvania

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day): Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
Equitable Gas Co. and Subsidiaries:						
Rogersville, Greene (Rogersville)	33	25	2,679	.....	.....	.....
Mars Co., The:						
Van Plant, Strong, Venango (Van)	2.5	1.3	.....	5,000	2,000	.....
Pinegrove Plant, Hampton, Venango (Oil City)	2	1	1,200	.....	.....	.....
Lamont Plant, Kane, Elk (Kane)	3	2.5	600	.....	.....	.....
Pennsylvania Gas Co.:						
Roystone, Sheffield (Warren)	11	10	2,600	.....	.....	.....
Quaker State Oil Refining Corp.:						
Jennings, Allegheny (Noblestown)*	(†)	0.1	23	.....	.....	.....
Sproul, Allegheny (Noblestown)*	(†)	0.1	9	.....	.....	.....
Total	51.5	40	7,111	5,000	2,000	.....

Texas

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day): Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
Amarillo Oil Co.:						
West Panhandle, Potter, Fain Plant (Masterson)	100	97.9	.....	14,000	34,500	.....
West Panhandle, Potter, Turkey Creek Plant (Fritch)	100	81.5	.....	21,400	40,500	.....
Amerada Petroleum Corp.:						
Adair, Terry (Brownfield)	1.5	0.8	.....	5,000	1,000	.....
Arkansas Fuel Oil Corp.:						
East Texas, Gregg (Greggton)	10	5.4	37,587	35,393	.....	.....
Carthage, Panola (Carthage)	100	63.2	.....	33,290	.....	6,337 Motor
Arkansas Louisiana Gas Co.:						
East Carthage, Panola (Carthage)	40	30	.....	14,831	.....	22,264
Jefferson, Marion (Jefferson)	31	14	.....	5,955	.....	9,927
Waskom, Harrison (Waskom)	170	125	.....	47,149	.....	120,290
Atlantic Refining Co.:						
Block 31, Crane (Crane)*	45	44	16,900	74,600	19,900	.....
Barnhart Hydrocarbon Corp.:						
Barnhart, Reagan (Big Lake)*	25	19	.....	38,000	19,000	.....
Black Hawk Gasoline Corp.:						
Alco-Graham, Jack (Graham)	4	2.5	.....	665	2,750	.....





Nice thing about UNIBOLT Flow Manifolds . . .

you buy only what your well needs, and no more

Since well conditions and completion methods differ widely, no one Christmas tree flow control of the "fixed design" type can possibly serve all wells efficiently. Not so with UNIBOLT Flow Manifolds, the components of which may be readily arranged in any design to exactly fit well requirements.

These flexible Flow Manifolds, composed of standard UNIBOLT Tees, Crosses, Adjustable Wing Valves or Chokes, can be combined in a dozen different ways. Thus, you buy exactly what is needed for a given well.

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THORNHILL CRAVER CO.
P. O. BOX 1184 HOUSTON, TEXAS

NATURAL-GASOLINE-PLANT SURVEY (Texas continued)

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day) Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
Bowie Gasoline Co.:						
Various, Montague (Bowie)	20	7	.....	30,000	10,000	.....
Brazos River Gas Co.:						
Various, Palo Pinto (Mineral Wells)	15	10	.....	16,000	3,700	.....
Cabot Carbon Co.:						
Estes Plant, North Ward Estes (Wickett)	30	15	.....	10,840	13,560	.....
Walton Plant, Kermit, Winkler (Kermit)	31	31	.....	23,830	17,000	.....
Carthage Co.:						
Carthage, Panola (Carthage)	475	350	.....	225,000	450,000 (Includes motor and some heavier products)	75,000
Caska Corp.:						
Quitman, Wood (Quitman)	4	2	.....	6,000	3,000	.....
Champlin Oil & Refining Co.:						
Feazel-Kinsey, Panola (Carthage)	210	(†)	.....	¶105,000	¶147,000	.....
Cities Service Oil Co. (Del.):						
Pampa, Gray (Pampa)*	40	40	.....	53,000	43,000	.....
West Levelland, Cochran (Lehman)	25	19	.....	30,000	10,000	.....
Chico, Wise (Chico)	25	24	.....	46,000	16,000	.....
West Seminole, Gaines (Seminole)	15	14	.....	36,000	15,000	.....
East Chico, Wise (Chico)	13	8	.....	13,000	5,000	.....
Cities Service Production Co.:						
Roberts Ranch, Ector (Odessa)	35	24	70,000	.....	.....	.....
Coates, George H.:						
Jay Simmons, Starr (La Reforma)	2	1	2,000	.....	.....	.....
Colorado Interstate Gas Co.:						
Panhandle, Moore, Fourway Plant (Dumas)	150	89	66,234	.....	.....	.....
Panhandle, Moore, Bivens Plant (Dumas)	165	91	23,197	.....	.....	.....
Coltexo Corp.:						
Panhandle, Gray (Lefors)	50	36.5	47,500	.....	.....	.....
Continental Oil Co.:						
Rincon, Starr (Rio Grande City)*	21.5	19.3	.....	6,867	23,010	.....
KMA, Wichita (Electra)*	11.2	7.8	55,430	.....	.....	.....
Todd Ranch, Crockett (Big Lake)	9.3	3.3	.....	22,453	7,406	.....
Delhi-Taylor Oil Corp. and Mayfair Minerals, Inc.:						
McAllen, Hidalgo (McAllen)	165	122.5	.....	30,800	68,500 (Includes heavier liquids)	.....

(Texas continued)

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day) Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
Dorchester Corp.:						
West Panhandle, Carson (White Deer)	110	62.1	.....	57,551	21,549	.....
Big Lake, Reagan (Texon)	6	5.1	11,487	.....	.....	.....
El Paso Natural Gas Co.:						
Sealy-Smith, Ward (Monahans)	54.3	(†)	.....	25,200	16,560 (26 lb. R.v.p.)	.....
Midkiff-Spraberry, Reagan (Midland)	141.2	(†)	.....	344,160	208,000 (26 lb. R.v.p.)	.....
Etexas Producers Gas Co.:						
Chapel Hills, Smith (Tyler)	18	9	.....	4,500	10,500	.....
Goliad Corp.:						
Kittie-Clay-Karon, Live Oak (Three Rivers)	165	150	.....	27,369	14,358	25,315
Hagist Ranch, Duval (Freer)	70	60	23,849	.....	.....	.....
Wilcox Plant, Lavaca (Provident City)	225	225	.....	45,168	22,206	.....
Graridge Corp.:						
Plant 1, Ibex, Shackelford (Albany)	10	6	.....	2,500	3,500	.....
Plant 2, Eastland, Eastland (Eastland)	10	5	.....	6,000	3,500	.....
Plant 3, South Bend, Young (Graham)	10	7	.....	2,500	5,000	.....
Grimes, Otha H.:						
Ringgold, Clay (Ringgold)	2	0.6	.....	2,000	2,500	.....
Eskota, Fisher (Trent)	1.5	1	.....	3,500	2,500	.....
North Dora, Nolan (Sweetwater)	3	1.8	.....	7,000	8,000	.....
Henderson, Frank C., Trust No. 2:						
West Panhandle, Hutchinson (Sanford)	60	38	25,000	.....	.....	.....
Honolulu Oil Corp.:						
Ropes, Hockley (Ropesville) (owned jointly with Signal)	2	1	.....	13,500	6,500	.....
White Flat, Nolan (Trent) (owned jointly with B. G. Byars, A. G. Hill, N. B. Hunt, L. C. Johnston, B. W. Payne)	6.5	5.5	.....	30,000	10,000	.....
Prentice, Yoakum (Tokio)	14	12	.....	25,000	12,500	.....
Howsley, A. M., Oper., Sappington Gasoline Plant:						
Jennings, Coleman (Glen Cove)	1.8	1.5	.....	1,688	1,483	.....
Huber, J. M., Corp.:						
Panhandle, Hutchinson (Borger)	75	64	34,000	.....	.....	.....

THE MODERN TREND IN OIL REFINERIES

HUDSON Solo-aire units pictured above operate in a large Texas Gulf Coast Refinery, in which Solo-aires are used for a complete range of refinery services, transferring 300 million BTU's per hour directly to air.

Over-all economic comparisons of HUDSON Solo-aire cooling versus water cooling for new refining units almost invariably result in selection of Solo-aire units for much or all process cooling.

In two complete 40,000 barrel sea-side refineries now being constructed abroad by one of the world's largest refiners, HUDSON Solo-aire units will be used for ALL process cooling services. NO WATER WILL BE USED FOR PROCESS COOLING.

In the United States in a 40,000 barrel refinery being built adjacent to an unlimited water supply, 50% of the total dissipated heat will be transferred directly to air through HUDSON Solo-aire units.

Operating results of HUDSON Solo-aire units installed in oil, gas and chemical plants throughout the free world have led to continuing repeat installations.

For new process installations and for replacement of high maintenance water-cooled equipment, Solo-aires offer in most cases clear-cut advantages. Let HUDSON assist you in objective analyses of air versus water cooling.

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92% lighter than cement-lined metal pipe

The approximate weight of a bundle of three 20-foot lengths of 4" pipe made of Tenite Butyrate is only 60 lbs. Cement-lined steel pipe, commonly used for the same purpose, would weigh approximately 720 lbs.

Because this plastic pipe is so light, it is extremely easy to handle. What's more, it can be cut with a hand saw and joined quickly with only slip-sleeve couplings and solvent cement. As a result, pipe made of Tenite Butyrate can be installed faster and easier. A crew of three men can lay 4,000 feet of 4" pipe in only one working day.

And pipe made of Tenite Butyrate is *tough*. It can take rough handling, and all normal back-filling operations.

Once in service, pipe of Tenite Butyrate remains free of corrosion—by sour crudes, salt water and alkali soils. Its smooth interior surface provides as much as 40% greater flow volume for any given head loss than does clean metal pipe of the same diameter. Moreover, this smooth surface offers no toe-hold where paraffin can start accumulating.

Could pipe with so many advantages help you in your operations? We will be glad to send you additional information about the properties and applications of pipe made of Tenite Butyrate and also the names of companies that produce the pipe and a complete range of fittings. Address: EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.

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BUTYRATE
an Eastman plastic

A 16-mm. sound-color film, "PLASTIC PIPELINES," is available upon request.

NATURAL-GASOLINE-PLANT SURVEY (Texas continued)

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Throughput, M.M.c.f. per day	Products (gallons per day): Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
Humble Oil & Refining Co.:						
Anahuac, Chambers (Monroe City)	100	74.2	38,460	.....	.....	.....
Clear Lake, Harris (Genoa)	125	106.5	42,800	15,250	.....	.....
Conroe, Montgomery (Conroe)	29	27.5	33,640	16,420	.....	.....
East Texas, Rusk (Overton)	23	11.5	.....	113,190	34,120	.....
Flour Bluff, Nueces (Corpus Christi)	17	13.7	5,110	.....	.....	.....
Heyser, Calhoun (Bloomington)	18	13.5	4,160	.....	.....	.....
Jourdanton, Atascosa (Jourdanton)	26	21.6	.....	15,220	13,450	.....
Pickton, Hopkins (Pickton)*	54	49.6	.....	56,120	31,440	.....
Pledger, Brazoria (Danciger)	190	173.6	.....	92,240	86,030	.....
Tomball, Harris (Tomball)	54	52	35,610	.....	.....	.....
Neches, Cherokee (Jacksonville)	9.5	7.1	38,840	.....	.....	.....
Tom O'Connor, Refugio (Refugio)	135	125	.....	23,110	33,970	.....
Hunt, H. L.:						
Whelan—N. Lansing, Harrison, (Harleton)	30	7	.....	1,645	11,758	3,332
Kerr-McGee Oil Industries, Inc.:						
Pampa, Carson (Pampa)	(†)	25	.....	33,000	27,000	.....
Cactus, Moore (Etter)	(†)	54	60,000	.....	.....	.....
Llano Grande Corp.:						
Wellman, Terry (Wellman)	2	1	7,575	.....	.....	.....
Lion Oil Co., Div. Mansanto Chemical Co.:						
Diamond "M"-Sharon Ridge, Scurry (Snyder)	55	20	.....	120,000	25,000	.....
Liquigas Co., The:						
Katy, Stonewall (Knox City)§	18	16	.....	55,000	25,000	.....
Lone Star Gas Co.:						
Trinidad, Henderson (Trinidad)	240	120	.....	16,000	12,000	.....
Springtown, Parker (Springtown)	125	70	.....	40,000	25,000	.....
Gordon, Palo Pinto (Gordon)	75	40	20,000	14,000	.....	.....
Pueblo, Eastland (Cisco)	40	25	18,000	.....	.....	.....
Lone Star Producing Co.:						
Fort Chadbourne, Runnels (Bronte)*	30	25	.....	36,000	6,000	.....
RCF, Eastland (Ranger)	(Processes raw condensates from other plants)		.....	47,000	24,000	.....
Plant 108, Eastland (Ranger)	12	8	35,000	.....	.....	.....

(Texas continued)

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Throughput, M.M.c.f. per day	Products (gallons per day): Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
Brooks, Stephens, (Breckenridge	6	5	21,000	.....	.....	.....
Magnolia Petroleum Co.:						
Burkburnett, Wichita (Burkburnett)	1.4	0.7	.....	3,224	9,593	.....
Desdemona, Eastland (Desdemona)	1.3	1.2	.....	3,207	5,920	.....
Electra, Wilbarger (Electra)	0.6	0.7	.....	3,230	5,364	.....
Pegasus, Midland (Midland)	60	49.7	.....	121,800	44,272	.....
Vanderbilt, Jackson (Vanderbilt)	60	68.3	.....	12,628	38,438	.....
Sabine, Gregg (Kilgore)	8	4.5	.....	43,332	13,356	.....
Kermit, Winkler (Kermit)	9.2	5	.....	4,752	4,213	.....
Natural Gas Pipelines Co. of America:						
Panhandle, Hutchinson (Fritch)	213	124	81,000	9,000	72,000	.....
Panhandle, Moore (Stinnett)	179	152	75,000	7,000	68,000	.....
Natural Gasoline Corp.:						
Smith (Hawkins)	(†)	20	.....	84,000	26,000	.....
Odessa Natural Gasoline Co.:						
South Cowden-Foster, Ector (Odessa)	47	42	.....	55,000	50,000	.....
Ohio Oil Co.:						
North Markham-North Bay City, Matagorda (Bay City)*	110	100	.....	65,137	.....	.....
Phoenix Lake, Orange (Orange)	11	10.5	.....	15,900	3,800	.....
Pan American Petroleum Corp.:						
Luby-Petronilla, Nueces Bishop*	37	27	.....	6,000	24,000	.....
North Cowden, Andrews-Ector (Odessa)*	60	48	.....	112,000	55,000	.....
South Fullerton, Andrews (Andrews)	55	50	.....	88,000	34,000	.....
Slaughter, Cochran-Terry (Sundown)	110	90	.....	136,000	85,000	.....
Levelland, Cochran-Hockley (Levelland)*	36	23	.....	49,000	30,000	.....
Hastings, Brazoria-Galveston (Alvin)	53	51	.....	21,000	30,000	.....
Three Bar, Andrews (Kermit)*	18	19	.....	48,000	16,000	.....
Midland Farms, Andrews (Andrews)	15	10	58,000	.....	.....	.....
Parade Co., The:						
East Texas, Rusk (Overton)	12	8	.....	60,400	43,600	.....
Pecos Co.:						
Spraberry, Midland (Midland)	30	25	.....	57,831	23,479	.....

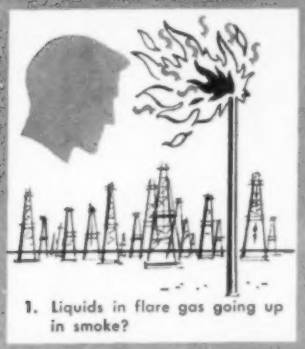
NATURAL-GASOLINE-PLANT SURVEY (Texas continued)

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day): Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
Santa Rosa, Pecos (Grandfalls)	30	27	.....	20,882	7,629	.....
Phillips Petroleum Co.:						
Chocolate Bayou, Brazoria (Alvin)	360	(†)	‡330,000	.....	.....	.....
West Panhandle, Moore (Phillips)	176	(†)	‡220,000	.....	.....	.....
Gray Plant, East Panhandle, Gray (Pampa)	80	(†)	‡110,000	.....	.....	.....
Lefors Plant, East Panhandle, Gray (Pampa)	54	(†)	‡50,000	.....	.....	.....
North Plant, East Panhandle, Gray (Pampa)	5.5	(†)	‡40,000	.....	.....	.....
Pampa Plant, East Panhandle, Gray (Pampa)	25	(†)	‡75,000	.....	.....	.....
Canadian Plant, West Panhandle, Hutchison (Phillips)	18	(†)	‡80,000	.....	.....	.....
Pantex Plant, West Panhandle, Hutchinson (Phillips)	30	(†)	‡65,000	.....	.....	.....
Rock Creek Plant, West Panhandle, Hutchinson (Phillips)	240	(†)	‡180,000	.....	.....	.....
Sanford Plant, West Panhandle, Hutchinson (Phillips)	85	(†)	‡110,000	.....	.....	.....
Sneed Plant, West Panhandle, Moore (Phillips)	260	(†)	‡195,000	.....	.....	.....
Hansford Plant, West Panhandle, Hansford (Guymon, Okla.)	140	(†)	‡106,000	.....	.....	.....
Sherman Plant, West Panhandle, Hansford (Guymon, Okla.)	380	(†)	‡220,000	.....	.....	.....
McElroy, Crane (Crane)	63	(†)	‡210,000	.....	.....	.....
Goldsmith, Ector (Goldsmith)*	315	(†)	‡700,000	.....	.....	.....
Fullerton, Andrews (Andrews)*	75	(†)	‡150,000	.....	.....	.....
Harper-Penwell-Jordan, Ector (Penwell)	41	(†)	‡80,000	.....	.....	.....
Seminole, Gaines (Seminole)	25	(†)	‡57,000	.....	.....	.....
Tex-Harvey, Midland (Spraberry)	48	(†)	‡150,000	.....	.....	.....
Pembrook, Upton (Midkiff)	48	(†)	‡165,000	.....	.....	.....
Various, Andrews (Andrews)	106	(†)	‡325,000	.....	.....	.....
Benedum, Upton (Rankin)	85	(†)	‡270,000	.....	.....	.....

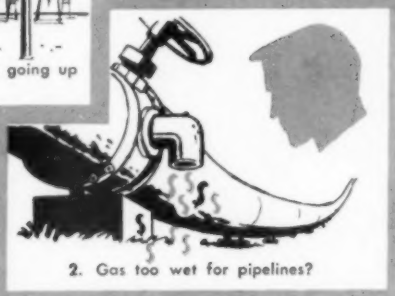
(Texas continued)

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day): Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
Plymouth Oil Co.:						
Susan Peak, Tom Green (San Angelo)*	4	2	1,338	.....	.....	.....
Pure Oil Co.:						
Dollarhide, Andrews	65	55.2	35,300	115,500	.....	.....
Van, Van Zandt (Van)	15	6	30,000	13,000	.....	.....
Reef Fields Gasoline Corp.:						
East Vealmore, Howard (Big Spring)	38	38	.....	225,000	75,000	.....
Renwar Oil Corp.:						
Mustang Island, Nueces (Corpus Christi)	50	30	25,140	.....	.....	.....
West Rockport, Aransas (Rockport)	15	10	19,200	.....	.....	.....
Richardson, Sid, Gasoline Co.:						
Keystone, Winkler (Kermit)	120	80	95,000	35,000	.....	.....
Runnels Gas Products Corp.:						
Cree-Sykes, Runnels (Winters)*	30	28	.....	40,000	20,000	.....
Rycade Oil Co.:						
Emperor, Winkler (Wink)	15	13	.....	5,000	5,000	.....
Shamrock Oil & Gas Corp.:						
Panhandle, Moore (Sunray)	400	350	.....	280,000	120,000	.....
Shell Oil Co.:						
TXL, Ector (Notrees)	112	64	.....	157,000	52,000	.....
Wasson, Yoakum (Denver City)	150	125	.....	136,000	130,000	.....
Bryan No. 17, Carson (Skellytown)	15	15.5	39,000	.....	.....	.....
Provident City, Lavaca (Sheridan)	80	76	.....	17,000	80,000	13,000
Sinclair Oil & Gas Co.:						
East Texas, Gregg (Longview)	17	9	.....	178,000	51,000	.....
East Texas, Rusk-Smith (Troup)	20	7	.....	45,000	60,000	.....
East White Point, San Patricio (Taft)	21	15	.....	11,000	19,000	.....
East Texas, Rusk (Price)	17	6	.....	62,000	106,000	.....
Sweetwater Canyon, Nolan (Sweetwater)	6	5	.....	14,000	9,000	.....
Hulldale, Schleicher (El Dorado)	20	16	.....	45,000	20,000	.....
Silsbee, Hardin (Silsbee)	73	40	.....	63,000	47,000	.....
South Hampton, Hardin (Silsbee)	25	20	.....	24,000	20,000	.....
Bender, Montgomery (Spring)	6	4	.....	3,000	3,000	.....
Skelly Oil Co.:						
Hutchinson, Carson-Gray*	90	(†)	‡360,000	.....	.....	.....

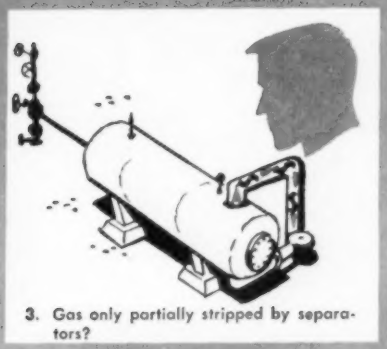
are you in these pictures?



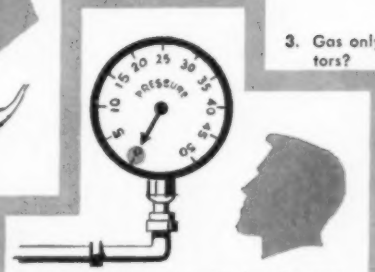
1. Liquids in flare gas going up in smoke?



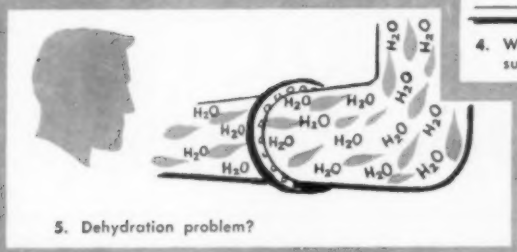
2. Gas too wet for pipelines?



3. Gas only partially stripped by separators?

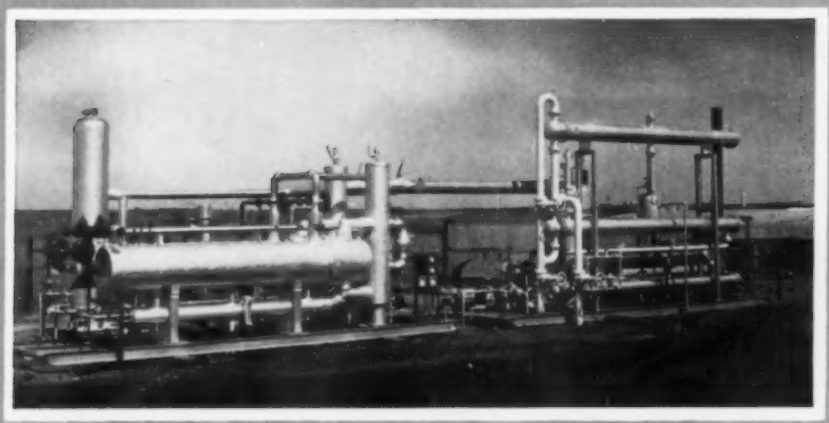


4. Well head pressure too low for pressure drop refrigeration?



5. Dehydration problem?

if so, CHILLGAS has the answer!



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- HIGH LIQUID RECOVERY
- DEHYDRATES WITH NO ADDITIVES
- NO PRESSURE DROP IN GAS STREAM
- LOW OPERATING COST — USES WASTE VAPORS FOR POWER
- SELF-ADJUSTING TO LOAD CHANGES

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NATURAL-GASOLINE-PLANT SURVEY (Texas continued)

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day) Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
Southern Minerals Corp.:						
Stratton, Nueces (Bishop)*	60	38	.....	12,000	14,000	.....
Saxet, Nueces (Corpus Christi)	50	18	.....	4,500	7,500	.....
Standard Oil Co. of Texas:						
Sivells Bend, Cooke (Gainsville)	5	3.5	8,825	4,675	.....	.....
Kelly-Snyder, Scurry (Snyder)	30	16.4	.....	100,760	32,260	.....
Sherman, Grayson (Sherman)	20	13.6	.....	15,710	5,300	.....
Sun Oil Co.:						
Jameson, Coke (Colorado City)*	55	55	50,000	60,000	.....	.....
Sun, Starr (Delmita)	55	50	45,000	55,000	.....	.....
Sunray Mid-Continent Oil Co.:						
Kelly-Snyder, Scurry (Snyder)	(†)	42	.....	340,250	114,508	35,341
Redfish Bay, Nueces (Corus Christi)	(†)	170	152,592	.....	.....	.....
Tennessee Gas Transmission Co.:						
Eagle Lake, Colorado (Eagle Lake)	100	83	.....	58,408	20,758	.....
Agua Dulce, Nueces (Banquete)	100	152	76,092	.....	.....	.....
Holiday, Archer (Wichita Falls)*	2	1	2,268	.....	.....	.....
Texas Co., The:						
Electra, Wichita (Electra)	2.2	(†)	.....	‡13,090	‡10,000	.....
Fuller, Scurry (Snyder)*	28	(†)	.....	‡100,000	‡60,000	.....
Texas Gas Corp.:						
Jefferson (Winnie)	200	200	.....	90,000	180,000 (Finished gasoline)	65,000 (Includes range oil, diesel fuel, gas oil)
Texas Natural Gasoline Corp. and Subsidiaries:						
Wimberly Plant (Tye)	(†)	(†)	‡100,000	.....	.....	.....
Walnut Bend Plant (Gainesville)	(†)	(†)	‡50,000	.....	.....	.....
Sandusky Plant (Whitesboro)	(†)	(†)	‡75,000	.....	.....	.....
Benedum Plant (Rankin)	(†)	(†)	‡175,000	.....	.....	.....
Pembrook Plant (Midkiff)	(†)	(†)	‡100,000	.....	.....	.....
Weiner-Floyd (Midland)	(†)	(†)	‡100,000	.....	.....	.....
Perkins Plant (Silver)	(†)	(†)	‡300,000	.....	.....	.....
Texas Pacific Coal & Oil Co.:						
Caddo, Stephens	6	1.8	.....	4,902	6,279	.....
Pardue-Toler, Fisher	5	2.2	.....	8,318	3,520	.....

(Texas continued)

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day) Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
Tidewater Oil Co.:						
South Sinton, San Patricio (Sinton)*	4	4	.....	.....	.....	1,600 (Oil)
Cayuga, Anderson (Cayuga)	25	18	.....	5,000	5,800	.....
West Bernard, Wharton (East Bernard)	32	30	.....	6,700	22,000	2,000
Yoward, Bee (Mineral)	4	3	.....	.....	.....	5,800 (Oil)
Turner & West Gasoline Co.:						
James Pool, Young (Graham)	3	2.5	.....	7,157	2,340	.....
Langston-Kleiner, Young (Loving)	1.5	0.8	.....	5,030	1,656	.....
United Gas Pipe Line Co.:						
Agua Dulce, Nueces (Banquete)	30	24	.....	4,000	45,000	.....
Cabeza Creek, Karnes (Runge)	100	100	.....	57,000	27,000	.....
Carthage, Panola (Carthage)	220	194	.....	96,000	304,000	.....
Coy City, Karnes (Karnes City)	40	90	.....	7,000	45,000	.....
Waggoner, W. T., Estate:						
Wilbarger (Rock Crossing)	2	1.3	.....	500	2,300	.....
Warren Petroleum Corp.:						
Plant 20 (Fairbanks)	(†)	34	.....	9,000	12,000	.....
Plant 27 (Holiday)*	(†)	15.5	.....	68,000	28,000	.....
Plant 28 (McLean)*	(†)	30	.....	28,000	42,000	.....
Plant 30 (Breckenridge)*	(†)	7.5	.....	30,000	17,000	.....
Plant 31 (Gladewater)	(†)	5.5	.....	37,000	43,000	.....
Plant 47 (Gregg-Tex)	(†)	5	.....	50,000	17,000	.....
Plant 62, Monahans, Ward (Wickett)*	(†)	23	20,000	.....	.....	.....
Plant 63, Runnels, Runnels (Wingate)	(†)	4	.....	8,000	3,000	.....
Plant 64, Waddell, Crane (Crane)	(†)	70	.....	140,000	40,000	.....
Plant 65, Cashen, Rusk (Overton)	(†)	1	10,000	.....	.....	.....
Plant 66, Spear, Gregg (Kilgore)	(†)	8	.....	55,000	25,000	.....
Waskom National Gas Corp.:						
Waskom, Harrison (Waskom)	50	25	1,000	300	.....	.....
West Gasoline Co.:						
Hull, Liberty (Hull)	20	5	.....	700	1,300	.....
Whelan, D. E. & R. J.:						
Whelan, Harrison (Marshall)	15	7.5	5,000 (14 lb.)	.....	.....	.....
Wiseco Processing Plant, Inc.:						
Plant 50, Wise (Bridgeport)	150	(†)	220,000	.....	.....	.....

NATURAL-GASOLINE-PLANT SURVEY (Texas continued)

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day): Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
Woodlawn Processing Corp.: Woodlawn, Harrison (Marshall)	60	30	.....	30,000	38,000 (Motor and some heavier products)	2,000
Young, Marshall R.: Cook, Shackelford, Albany)*	(†)	4.5	3,700	.....	.....	.....
Cayuga, Anderson (Malakoff)*	(†)	1.3	450	.....	.....	.....
Total	11,232	6,706.3	6,975,284	6,245,637	4,335,435	387,206

§Bought early 1958 by Cities Service Oil Co.

Utah

Mountain Fuel Supply Co.: Clay Basin (Daggett)	22	10	400	.....	.....	.....

West Virginia

Hope Natural Gas Co.: Hastings, Wetzel (New Martinsville)	250	130	.....	78,800	38,800	.....
Pure Oil Co.: Kanawha (Cabin Creek)	3	2.8	3,300	800	.....	.....
Quaker State Oil Refining Co.: Mills, Wetzel (Jacksonburg)*	(†)	1.1	282	.....	.....	.....
South Penn Natural Gas Co.: Blackshere Plant, Marion (Mannington)	(†)	(†)	‡800	.....	.....	.....
Copeley Plant, Lewis (Camden)	(†)	(†)	‡800	.....	.....	.....
Clay Plant, Clay (Newton)	(†)	(†)	‡2,500	.....	.....	.....
Edgell Plant, Roane (Clova)	(†)	(†)	‡1,200	.....	.....	.....
Fairview Plant, Monongalia (Fairview)	(†)	(†)	‡3,000	.....	.....	.....
Hartley-Stephens Plant, Ritchie (Brokard)	(†)	(†)	‡2,600	.....	.....	.....
Lynch Plant, Harrison (Wolf Summit)	(†)	(†)	‡3,500	.....	.....	.....
Metz Plant, Marion (Mannington)	(†)	(†)	‡1,200	.....	.....	.....
Morgan Plant, Wetzel (Smithfield)	(†)	(†)	‡3,000	.....	.....	.....
McElroy Plant, Tyler (West Union)	(†)	(†)	‡500	.....	.....	.....
Oil Siding and Blue Creek Blending Plant, Kanawha (Blue Creek)	(†)	(†)	‡500	.....	.....	.....
Pine Grove Plant, Wetzel (Pine Grove)	(†)	(†)	‡3,500	.....	.....	.....
Rock Creek Plant, Roane (Walton)	(†)	(†)	‡1,200	.....	.....	.....

(West Virginia continued)

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day): Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
Shinnston Plant, Harrison (Shinnston)	(†)	(†)	‡500	.....	.....	.....
Seckman Plant, Tyler (West Union)	(†)	(†)	‡500	.....	.....	.....
Stringtown Plant, Tyler (West Union)	(†)	(†)	‡3,000	.....	.....	.....
Sweeney Plant, Tyler (West Union)	(†)	(†)	‡500	.....	.....	.....
Tanner Plant, Gilmer (Grantsville)	(†)	(†)	‡3,000	.....	.....	.....
Victor Plant, Kanawha (Pinch)	(†)	(†)	‡3,500	.....	.....	.....
Broadwater Plant, Tyler (Middlebourne)	(†)	(†)	‡300	.....	.....	.....
Wood-Elk Fork-Eddy Plant, Tyler (Sistersville)	(†)	(†)	‡1,000	.....	.....	.....
Bennett Plant, Gilmer (Grantsville)	(†)	(†)	‡500	.....	.....	.....
United Fuel Gas Co.: Cobb Dryer, Kanawha (Clendenin)	100	45	.....	‡31,100	‡12,200	.....
Elk Dryer, Kanawha (Charleston)	40	4	.....	‡6,200	‡2,600	.....
Hubball Dryer, Lincoln (Branchland)	60	31	.....	‡26,300	‡8,100	.....
Total	453	213.9	40,682	143,200	61,700	.....

Wyoming

Continental Oil Co.: Sussex, Johnson (Lynch)*	15	15	.....	11,621	6,054	.....
Mobil Producing Co.: Manderson, Big Horn (Worland)	15	8	.....	100	1,000	.....
Mountain Fuel Supply Co.: Church Buttes (Uinta)	100	25	1,100	.....	.....	.....
Northern Utilities Co.: Sand Draw, Fremont (Riverton)	50	42	2,700	.....	.....	.....
Ohio Oil Co.: McFadden, Carbon (Rock River)*	2.5	1.5	.....	3,079	941	.....
Pan American Petroleum Corp.: Elk Basin, Park-Carbon (Elk Basin)*	12	11	.....	40,000	22,000	.....
Salt Creek, Natrona (Midwest)*	25	23	.....	64,000	47,000	.....
Pure Oil Co.: Washakie (Worland)	42	42	25,000	35,000	.....	.....
Sinclair Oil & Gas Co.: Sweetwater, Barroil	9	7	15,000	.....	.....	.....
Total	270.5	174.5	43,800	153,800	76,995	.....

Journal Survey of

Cycling Plants in United States

Recap of U. S. Cycling Plants as of January '58

State—	No. plants	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day): Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
Arkansas	1	52.5	48.5	42,500	30,000	.....	.....
California	3	237	203.1	.....	155,250	126,641	75,000
Colorado	1	1	1	.....	2,000	1,500	.....
Kentucky	1	5.5	0.8	250	.....	.....	.....
Louisiana	13	973	608.4	75,000	1,112,708	1,383,152	1,720,554
Mississippi	1	100	100	36,000	20,000	.....	.....
Oklahoma	3	280.4	276.9	30,000	163,562	235,446	837
Pennsylvania	1	45	22	3,700	.....	.....	.....
Texas	31	3,128.7	2,534.7	267,700	1,471,173	1,229,759	338,499
West Virginia	2	70	35	3,700	5,000	3,000	.....
Total	56	4,848.1	3,807.8	455,150	2,959,693	2,979,498	2,134,890

State by State Listing as of January '58

Arkansas

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day): Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
McKamie Gas Cleaning Co.:						
McKamie-Patton, Lafayette (Stamps)	52.5	48.5	42,500	30,000	.....	.....

California

Ohio Oil Co.:						
South Coles Levee, Kern (Bakersfield)	75	70.1	.....	42,250	37,641	.....
Union Oil Co. of California:						
Coalinga, Fresno (Coalinga)	32	27	.....	38,000	30,000	.....
Western Gulf Oil Co.:						
Paloma, Kern (Bakersfield)	130	106	.....	75,000	59,000	75,000
Total	237	203.1	.....	155,250	126,641	75,000

Colorado

Ginther, Warren & Ginther:						
Leader (Adams)	1	1	.....	2,000	1,500	.....

CYCLING-PLANT SURVEY

Kentucky

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f per day	Products (gallons per day): Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
Ashland Oil & Refining Co., Inc.:						
Martha, Johnson (Martha)	5.5	0.8	250	.....	.....	.....

Louisiana

Acadia Corp.:						
Egan, Acadia (Egan)	120	110	.....	60,000	85,000	15,000
California Co., The:						
Lake St. John, Tensas-Concordia (Water Proof)	110	110	75,000	52,000 (Propane)	.....	.....
Cotton Valley Operators Committee:						
Cotton Valley, Webster (Cotton Valley)	150	150	.....	126,000	210,000 (iC5 and heavier)	.....
Gulf Oil Corp.:						
Krotz Springs, St. Landry (Krotz Springs)	100	30	.....	68,000	189,000	.....
Magnolia Petroleum Co.:						
Opelousas, St. Landry (Opelousas)	23	20.4	.....	9,058	.....	.....
Pan American Petroleum Corp.:						
South Jennings, Jeff Davis (Jennings)	55	42	.....	8,000	45,000	19,000
Sohio Petroleum Co.:						
Washington, St. Landry	50	35	.....	34,000	.....	130,000
Sunray Mid-Continent Oil Co.:						
West Tepetate, Jeff Davis (Elton)	(†)	9	.....	26,479	35,736	8,826
South Sarepta, Bossier (Sarepta)	(†)	24	.....	121,049	.....	418,604
Benton, Bossier (Benton)	(†)	57	.....	333,027	363,416	430,551
Northwest Branch, Acadia (Branch)	(†)	21	.....	128,495	.....	485,573
Texas Co., The:						
Bateman Lake, St. Mary (Berwick)	145	(†)	.....	‡8,000	‡135,000	.....
Erath, Vermilion (Erath)	220	(†)	.....	‡138,600	‡320,000	‡213,000
Total	973	608.4	75,000	1,112,708	1,383,152	1,720,554

Mississippi

California Co., The:						
Cranfield, Adams (Natchez)	100	100	36,000	20,000 (Propane)	.....	.....

HERE'S PROOF* . . .

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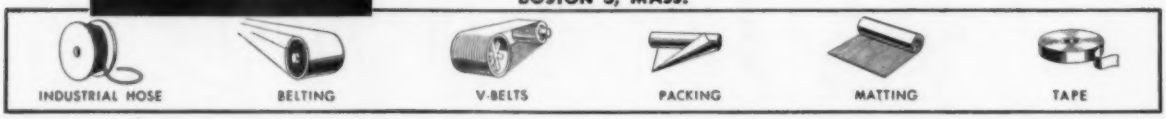

CYCLING-PLANT SURVEY

Oklahoma

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day): Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
Magnolia Petroleum Co.:						
Chitwood, Grady (Rush Springs)	23.9	23.4	.....	7,562	10,446	837
Redco Corp.:						
Seminole, Seminole (Seminole)	¶16.5	¶16.5	¶30,000	¶70,000	.....	.....
Shell Oil Co.:						
Elk City, Beckham (Elk City)	240	237	.....	86,000	225,000	.....
Total	280.4	276.9	30,000	163,562	235,446	837

Texas

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day): Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
American Petrofina Co. of Texas (formerly American Liberty Oil Co.):						
Blessing, Matagorda	32	28	.....	2,100	8,400	2,700
Breckenridge Gasoline Co.:						
Hill, Stephens (Eliasville)	¶8	¶7.5	¶8,500	¶6,100	.....	.....
Rodessa, Cass (Bivins)	¶30	¶25	¶11,000	¶5,000	.....	.....
Champlin Oil & Refining Co.:						
Stratton-Agua Dulce, Nueces (Bishop)	165	¶150	¶71,400	¶54,600	.....	.....
Gulf Plains Plant, Nueces (Bishop)	125	¶125	¶73,500	¶52,500	.....	.....
Coastal Plant, Nueces (Bishop)	125	¶75	¶48,300	¶49,250	.....	.....
Distillate Production Corp.:						
North Houston, Harris (Houston)	75	50	.....	30,000	32,000	3,000
Francitas Gas Co.:						
Francitas, Jackson (Blessing)	35	15	.....	4,800	12,000	1,200
Gasoline Production Corp.:						
Tuleta, Bee (Pettus)	40	18	.....	3,100	.....	10,500
Gillring Oil Co.:						
Agua Dulce, Nueces (Banquete)	60	28	.....	5,000	7,500	.....
Humble Oil & Refining Co.:						
Julian, Kenedy (Encino)	8.2	7.8	.....	.....	.....	33,220
Katy, Waller (Katy)	555	520.4	.....	556,010	383,710	62,940
La Gloria Oil & Gas Co.:						
La Gloria, Jim Wells-Brooks (Falfurias)	330	310	.....	180,000	155,000	25,000
Lone Star Producing Co.:						
Opelika, Henderson (Murchison)	100	85	.....	7,000	33,000	.....
Carthage, Panola (Carthage)	100	40	.....	.....	23,000	1,000
Chapel Hill, Smith (Tyler)	45	35	.....	14,000	26,000	.....
Luling Oil & Gas Co., Oper., Glen Cove Gasoline Plant:						
Glen Cove, Coleman	5.5	5.5	.....	5,175	3,225	.....

CYCLING-PLANT SURVEY (Texas continued)

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day): Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
Magnolia Petroleum Corp.:						
Seeligson, Jim Wells (Premont)	206	138.9	.....	65,637	67,125	3,730
Midland Gasoline Corp.:						
Conroe, Montgomery (Conroe)	40	38	45,000	.....	.....	24,000
Pan American Petroleum Corp.:						
Burnell-North Pettus, Karnes-Bee-Goliad (Pettus)	166	182	.....	90,000	127,000	13,000
Old Ocean, Brazoria (Sweeny)	350	328	.....	140,000	131,000	.....
Plomo Co., The:						
Brayton, Nueces (Robstown)	60	50	.....	20,000	32,000	.....
Plymouth Oil Co.:						
Plymouth, San Patricio (Sinton)	65	46	.....	11,366	10,783	61,984
Redco Corp.:						
Kamay, Wichita (Mankins)	¶2	¶2	¶10,000	¶5,000	.....	.....
Shell Oil Co.:						
Sheridan, Colorado (Sheridan)	110	101	.....	77,000	113,000	24,000
South-Tex Corp.:						
Agua Dulce (Robstown)	80	50	.....	18,500	20,000 (Includes some heavier products)	.....
Superior Oil Co.:						
Lake Creek, Montgomery (Conroe)	55	(†)	.....	47,035	40,216	14,425
Ramsey, Colorado (Alleyton)	55	(†)	(Operates as one unit with above plant)			
Tidewater Oil Co.:						
Long Lake, Anderson (Palestine)	40	22	.....	4,000	4,800	.....
New Hope, Franklin (Winnsboro)	6	6	.....	.....	.....	37,800
Trinity Gas Corp.:						
Sejita, Duval (Falfurias)	55	45	.....	18,000	.....	20,000
Total	3,128.7	2,534.1	267,700	1,471,173	1,229,759	338,499

West Virginia

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day): Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
Manufacturers Light & Heat Co.:						
Wetzel (Porters Falls)	45	22	3,700	.....	.....	.....
Owens, Libbey-Owens Gas Dept.:						
Kanawha (Charleston)	25	13	.....	5,000	3,000	.....
Total	70	35	3,700	5,000	3,000	.....

Journal Survey of

Canadian Field-Processing Plants

Recap of Canadian Plants

Province—	No. plants	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day): Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
Alberta	8	271.8	184.9	63,300	117,870	23,720	63,000
British Columbia	1	300	190	.....	35,780	60,000	.....
Saskatchewan	1	3	3	2,400	.....	.....	.....
Total	10	574.8	377.9	65,700	153,650	83,720	63,000

Province-by-Province Listing as of January '58

Alberta

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day): Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
Ajax Processors, Ltd.:						
St. Albert	20	20	4,500	.....	.....	.....
Anglo American Exploration, Ltd.:						
Hartell	10	6	6,000	.....	.....	.....
British American Oil Co., Ltd.:						
Stettler	15	7	.....	21,600	4,320	.....
Pincher Creek*	60	59.2	.....	.....	.....	63,000
Imperial Oil, Ltd.:						
Leduc	35	29.3	.....	68,570	14,200	.....
Redwater	10.8	6	.....	27,700	5,200	.....
Golden Spike*	21	7.4	15,800	.....	.....	.....
Royalite Oil Co., Ltd.:						
Turner Valley*	100	50	37,000	.....	.....	.....
Total	271.8	184.9	63,300	117,870	23,720	63,000

British Columbia

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day): Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
Pacific Petroleums, Ltd., and Westcoast Transmission Co., Ltd.:						
Taylor	300	190	.....	35,780	60,000	.....

Saskatchewan

Location (field, county, and nearest town)—	Capacity, M.M.c.f. per day	Through-put, M.M.c.f. per day	Products (gallons per day): Combined nat. gaso. and LPG stream	Total butane and lighter	Natural gasoline	Liquids heavier than nat. gasoline
Imperial Oil, Ltd.:						
Smiley	3	3	2,400	.....	.....	.....

Who's Building, Where, Target Date for Completion, and Capacity

A

• **Anchor Gasoline Corp.** is expanding capacity from 25 to 40 M.M.c.f.d. at East Krotz Springs, La.

• **Arkansas Louisiana Gas Co.** plans to build a $3,000,000 300-M.M.c.f.d. hydrocarbon extraction plant at Magnolia, Ark., by mid-1959. It will extract 78,000 gal. of ethane daily.

B

• **Bass, Harry & Sons, Inc.,** plans a $2,000,000, 100-M.M.c.f.d. plant in Pembina field, Alberta. It will produce 200,000 gal. of liquid products daily. Completion is set for late 1958 or early 1959. Plant will be operated by Goliad, Ltd., a subsidiary of Bass.

• **Brazos River Gas Co.** plans to expand capacity from 15 to 30 M.M.c.f.d. at Mineral Wells, Tex., by fall 1958.

• **British American Oil Co., Ltd.,** will increase capacity from 60 to 120 M.M.c.f.d. and add LPG facilities at Pincher Creek field near Lethbridge, Alta., by September 1, 1958. **Ralph M. Parsons Co. of Canada, Ltd.,** has contract.

C

• **Carthage Co.** will complete September 1958, facilities to recover 70,000 gal. daily of ethane at its plant in Panola County, near Carthage, Tex. Cost will be $1,300,000. **Hudson Engineering Corp.** has contract.

• **Coltexo Corp.** will complete May 1, 1958, a 45-M.M.c.f.d. expansion of its Panhandle plant in Gray County near Lefors, Tex. **Pona Engineers, Inc.,** has contract.

NEW-CONSTRUCTION SURVEY (Continued)

D

• **Dickerson & Hulsey Gasoline Co.** of Magnolia, Ark., plans a $1,500,000, 10-M.M.c.f.d. plant at 4000 Groupe Field, Nolan County, near Sweetwater, Tex.

E

• **El Paso Natural Gas Co.** has applied to FPC for a 90-M.M.c.f.d. expansion of its Jal No. 3 plant, Lea County, near Jal, N. M.

Application for a 100-M.M.c.f.d. plant at Aneth field, San Juan County, Utah, near Cortez, Colo., has been filed with FPC.

H

• **Humble Oil & Refining Co.** will build the world's largest cycling plant in Kleberg County, Texas, 15 miles south of Kingsville. Capacity will be 750 M.M.c.f.d. and 25,000 bbl. daily of liquid products will be recovered. Construction will start midsummer 1958, with completion set for mid-1960.

Expansion of its Flour Bluff plant, Nueces County, near Corpus Christi, Tex., from 17 to 35 M.M.c.f.d. will be completed January 1958.

• **Hunt, H. L.,** will complete April 15, 1958, a 10-M.M.c.f.d. plant at Clear Creek field, Beauregard Parish, near Kinder, La. **Pona Engineers, Inc.,** has contract.

L

• **La Gloria Oil & Gas Co.** will complete March 1, 1958, facilities to increase LPG and ethane recovery at its plant near Falfurrias, Tex. **Hudson Engineering Corp.** is contractor.

• **Loffland & Allison Gas Co.** (J. M. Loffland Co. and B. F. Allison Drilling Co.) will complete a $400,000, 8-M.M.c.f.d. plant 4 miles south of Fort Morgan, Colo., mid-1958. **Green Brothers** of Fort Morgan has contract.

• **Lone Star Producing Co.** will complete July 1, 1958, a $2,000,000, 100-M.M.c.f.d. acid-gas removal plant at Fashing-Edwards field, Atascosa County, near Karnes City, Tex. **Gasoline Plant Construction Corp.** has contract.

R

• **Reef Fields Gasoline Corp.** will complete April 1958, a 65-M.M.c.f.d. expansion of its plant at East Vealmoor field, Howard County, near Big Spring, Tex. **Delta Engineering Corp.** has contract.

S

• **Shell Oil Co.** has under way expansion of its Iowa plant, Calcasieu Parish, near Iowa, La. Liquid capacity will be increased 24,000 gal. daily. **Farnsworth & Chambers** of Houston will complete the project May 1, 1958.

• **Signal Oil & Gas Co.** will complete September 1958, additions to its Tioga, N. D., plant at a cost of $500,000. **Hudson Engineering Corp.** and **Hammond Tank Co.** are contractors.

• **Sinclair Oil & Gas Co.** is expanding capacity from 6 to 9 M.M.c.f.d. at Plant 27 near Sweetwater, Tex.

Plant 29 will be completed at Gladiola field, Lea County, near Tatum, N. M., in the second quarter of 1958. **Dresser Engineering Co.** has contract for the 10-M.M.c.f.d. plant.

• **Sioux Oil Co.** is building a $100,000, 4-M.M.c.f.d. plant at Newcastle, Wyo.

• **Southern Union Gas Co.** completes March 1, 1958, a 65-M.M.c.f.d. plant at Jicarilla field, Rio Arriba County, New Mexico. **Pona Engineers, Inc.,** has contract.

• **Sun Oil Co., et al.** (Pan American Petroleum Corp., Sinclair Oil & Gas Co., Cities Service Oil Co., Shell Oil Co., Union Oil Co., Oklahoma Natural Gas Co., Kerr-McGee Oil Industries, Inc., Anderson-Prichard Oil Corp.) will build a plant at Laverne field, Oklahoma, by spring 1959. Capacity will be 100 M.M.c.f.d. and 100,000 gal. daily of liquids will be produced. Sun Oil will operate plant.

• **Steelman Gas, Ltd.,** will complete a $20,000,000, 25-M.M.c.f.d. plant northeast of Estevan, Sask., by September 1958.

T

• **Tennessee Gas Transmission Co.** will complete a 10-M.M.c.f.d. absorption-type plant near Lovington, N. M., early 1958. It will produce 43,000 gal. daily of propane, butanes, and natural gasoline.

• **The Texas Co.** will complete October 15, 1958, a 35-M.M.c.f.d. plant at Camrick field, Beaver County, Oklahoma, near Perryton, Tex. **O. L. Olsen Co., Inc.,** has contract.

• **Texas Natural Gasoline Corp.** and **Tennessee Gas Transmission Co.** will complete November 1958, a $3,000,000, 150-M.M.c.f.d. plant in St. Bernard Parish near New Orleans, La. **Fluor Corp., Ltd.,** has contract. Product fractionation facilities will be designed to handle 380,000 gal. daily of liquid products. Initial plant production is estimated at 120,000 gal. daily with an increase in volume as additional gas is connected. Propane, normal butane, isobutane, and natural gasoline will be produced.

U

• **United Fuel Gas Co.** will complete December 1, 1958, a 170-M.M.c.f.d. extraction plant in Wayne County, near Kenova, W. Va. **J. F. Pritchard & Co.** is building the plant which will cost $7,000,000.

W

• **Warren Petroleum Corp.** and **Sunray Mid-Continent Oil Co.** plan to build a plant near Mocane pool, Beaver County, Oklahoma, by late 1958. The 100-M.M.c.f.d. plant will be the refrigeration-absorption type, with liquid output of 100,000 gal. daily. Warren will operate the $3,000,000 plant.

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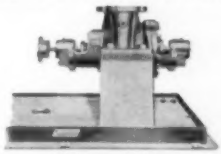

TYPE HVC
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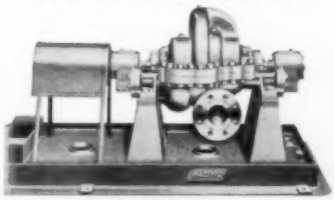
To 600 PSIG—To 1000 DIFF. HD. FT.



TYPE RHC
To 500°F.—50 to 3000 GPM
To 700 PSIG—To 1300 DIFF. HD. FT.

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To 850°F.—100 to 2500 GPM
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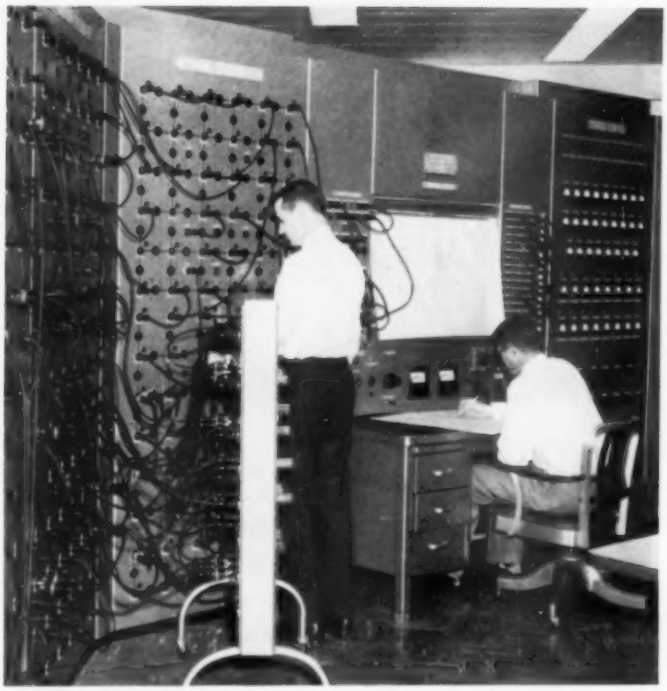
PIPELINES

Pipeline analyzer

tackles three-part chore on a gas-gathering system

The first installment reported the operation of the McIlroy analyzer, how it works, and factors to consider while studying a pipeline system. This installment takes up a specific study of a gas-gathering system and also outlines other uses of the computer at Midwest Research Institute.



DISTRIBUTION PROBLEM is set up on McIlroy Pipeline Network Analyzer.

PART 2 OF TWO PARTS

BY PAUL C. CONSTANT
Midwest Research Institute

A RECENT study made on the computer was for a gas-gathering system run with three specific objects in mind; namely: (1) locating any bottlenecks, if any, (2) evaluating pressure variations, and (3) checking the operation of the transmitting system.

This problem was somewhat different from other low-pressure gas systems that have been studied at MRI. There were more wells (sources) than were available on the McIlroy analyzer. Since each well was at a different pressure, it was not possible to parallel sources so as to obtain a greater number than the six available ones.

Having a minimum number of loads in the gathering system, we could have rewired the analyzer, selected proper scale factors, and used the loads as sources and the source rheostats as loads. Since this entailed too much work, the system was merely reversed on paper, and viewed as a regular gas-distribution problem. That is, the wells were represented as loads (consumption points), and the consumption points of the gathering system were represented by loads.

For simplicity and ease of explanation, only a portion of the network will be discussed here. A schematic drawing (not to scale) of this network is given in Fig. 6. The data given in Figs. 4 and 5 (appearing in The Oil and Gas Journal, March 31 1958) are for the problem discussed here.

Before the forms given in Figs. 4 and 5 can be completed, certain preliminary information must be obtained, such as:

1. Pipe diameters.
2. Length of pipe sections.
3. k_p, loss coefficient of pipe.
4. A, arbitrary constant to account for flow units.
5. Z, the pressure-drop function.
6. B, the pressure-voltage conversion factor.
7. G, conversion factor, amperes per unit flow.
8. θ, factor for converting pipe-coefficients, k_p to fluistor-coefficients, k_f.

The pipe diameters and lengths are known from the physical properties of the system, see Table 2. The remaining information is obtained through the use of an appropriate gas formula. The Panhandle formula (1.85-power, variable density) was used in this study.

From the formula for flow (thousands cubic feet per hour at standard conditions):

$$Q = 18.16 \times 10^{-3} E \times [(P_1^2 - P_2^2)/(TL\,\sigma^{0.854})]^{0.539} \times (T_o/P_o)^{1.079} \times d^{2.618} \quad (1)$$

and from the definition of the pressure-drop function:

$$Z = P_1^2 - P_2^2 \quad (2)$$

it is easily seen that:

$$Z = \frac{1.658\,\sigma^{0.85}\,T}{10^3\,E^{1.85}} (P_o/T_o)^2 \times (10^6\,L/d^{4.85})\,Q^{1.85} \quad (3)$$

or

$$Z = Ak_p\,Q^{1.85} \quad (4)$$

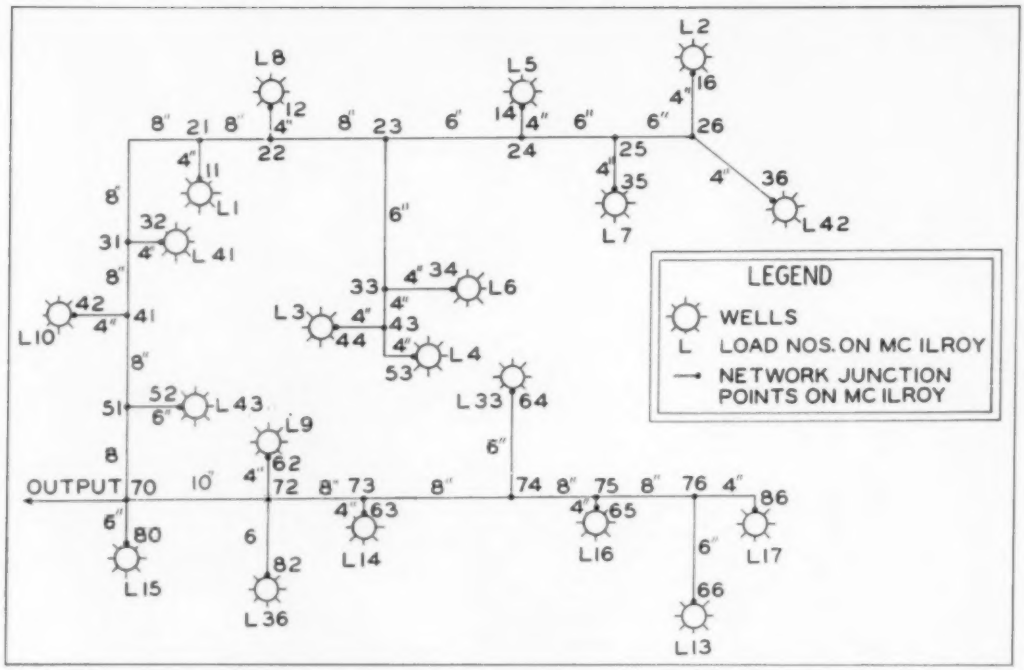
where:

$$A = \frac{1.658\,\sigma^{0.85}\,T}{10^3\,E^{1.85}} (P_o/T_o)^2 \quad (5)$$

$$\mu = 10^6/d^{4.85} \quad (6)$$

$$k_p = \mu L \quad (7)$$

Hence, with known lengths of all pipelines and Equation 7, the loss coefficient for each pipe section may be found. What remains to be determined now are Items 5 through 8. Before these can be found, the basis



GATHERING SYSTEM is shown in schematic drawing, not to scale. Fig. 6.

of the physical system must be known; that is, what are σ, T, P_o, T_o, and E.

For this problem the basis is:

1. Specific gravity referred to air, $\sigma = 0.7$.
2. Flowing-gas temperature, Rankine, $T_o = 520°$ R.
3. Base temperature, Rankine, $T_o = 520°$ R.
4. Base pressure, psia., $P_o = 14.73$.
5. Efficiency coefficient, E = 0.80.

Substituting our known physical parameters into Equation 5 and solving:

$$A = \frac{1.658\,(0.7)^{0.93}\,520}{10^3\,(0.80)^{1.85}} \times (14.73/520)^2 \qquad (8)$$

or

$$A = 7.613 \times 10^{-4}$$

Knowing A, only the conversion factors (B, G, and θ) remain to be determined. A word of caution at this point is in order. That is, before an attempt is made to select these factors, it is wise to know the ranges of the components of the analyzer being used. As an example, referring to Table 1, it is easily seen that there are limitations as to the number of loads that can represent flows analogous to 2 amp. Also there are current limits for the sources. Other restrictions are those of fluistor-operating voltages and coefficients.

The range of fluistor values available at the institute is 0.5 to 220.

TABLE 1—CAPACITIES OF LOAD AND SOURCES

Type	No.	Safe current capacity (amp.)	Resistance range (ohms)
Load	24	0.5	0-225
Load	4	1.0	0-75
Load	16	1.0	0-50
Load	2	2.0	0-75
Load	1	4.4	0-16
Load*	1	4.47	25
Load*	1	3.46	25
Source	1	10.0	0-5
Source	1	7.9	0-8
Source	1	4.47	0-25
Source	1	4.47	0-25
Source	1	3.46	0-25
Source	1	2.45	0-50

*Can be used for either source or load—no permanent meter wired into circuit.

This, however, is not too critical as there is a supply of over 600, and one may take advantage of series or paralleling wiring techniques to obtain the desired value.

The most serious problem in paralleling comes in attempting to get a large number of fluistor coefficients much below 0.01, as it takes too many paralleling adaptors and makes the setup more cumbersome and needlessly more time consuming.

The restrictions on voltages are that no fluistors should be operated at more than 4.6 V. The most linear-operating range is from 0.5 to 3.5 volts, so an attempt is made to choose a value of B which is based on 2.5 to 3 V. per section or line.

The next step in the problem is to choose a value for B. In doing this we must be cognizant of two things; namely: (1) what is the maximum Z across our network? and (2) what range of values of θ can we use so as not to have to worry about the fluistor range? The second question can be answered by studying the relation of θ as a function of B and G or:

$$\theta = A\,(B/G^{1.85}) \qquad (9)$$

The first comes from knowing our system and the operating pressures we desire, and realizing that:

$$B = \text{volts}/Z$$

For our gathering-system study the three conversion factors were chosen as follows:

1. Selection of voltage conversion factor, B:
   - Given or assumed:
     - Maximum Z = 3,000.
     - Assume B = 0.01.
     - Ten pipe sections covered by Z = 3,000.
   - Calculations:
     - V = BZ = 0.01 × 3,000 = 30 V., therefore,
     - Voltage per section, V = 30/10 = 3 V.

2. Selection of current conversion factor, G:
   - Given:
     - Total input flow, Q = 802 M.c.f. per hour.

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Assume G = 0.02.
Total current input, I = 802 × 0.02 = 16.04 amp.

This value exceeds any one source capacity, but two may be paralleled to meet the requirements.

3. Calculation of conversion factor between loss coefficient of pipe and fluistor coefficient, θ.

Substituting calculated and assumed values in Equation 9, we have:

$$\theta = A\,(B/G^{1.85}) = 7.613 \times 10^4\ (0.01/0.02^{1.85}) = 1.0536 \times 10^{-2}$$

With the above information, the fluistor values are calculated (according to $k_f = \theta k_p$), thus completing Table 2. The work sheets of Figs. 4 and 5 are then completed and the problem is put on the computer.

First study . . . This study was that of checking the operation of the system. Questions to be answered were:

- Can the required output be delivered at the required pressures?
- How much flow from each well is required for the established pressures?

To answer the first question, the system was energized, and the required pressures at the wells set. The means of setting these pressures was to measure the voltage between the wells and a reference point (in this case it was at the source point, Terminal 70). The voltages (pressures) were balanced by setting the load rheostats for the proper consumption rates. These pressures were maintained, and the source current was measured. The value was correct, I = 16.04 amp., which indicated that the system was transmitting to desired results as far as pressures were concerned.

To further check the operation of the system, it was necessary to read each load meter to see if the required flow in each load was correct. This would answer the second question. These readings did check, and their sum was that of the input flow. If, however, they did not all meet their individual requirements, reevaluation of the system would have to be made. Questions then to be answered would be:

- Can pressure requirements be relaxed so that the flows could be maintained?
- Can the flows be had by system alterations such as rerouting of lines or changes in pipe diameters?

In answering the first question, it would be necessary to determine the extent of pressure variations that would be had in fulfilling the load flow requirements. If they were slight, it might be possible to use the exist-

TABLE 2—SYSTEM PIPE DATA

Pipeline section	Pipe size (in.)	Length (miles)	k_p	k_f
26-36	4	2.42	2,500	26.34
16-26	4	0.266	276	2.91
25-26	6	0.719	104	1.10
25-35	4	0.266	276	2.91
24-25	6	1.21	176	1.85
14-24	4	0.125	130	1.37
23-24	6	1.72	250	2.63
23-33	6	2.35	342	3.60
33-34	4	0.342	354	3.73
33-43	4	0.137	142	1.50
43-44	4	0.236	245	2.58
43-53	4	0.337	349	3.68
22-23	8	1.48	55	0.58
12-22	4	0.119	123	1.30
21-22	8	0.606	22.6	0.238
11-21	4	0.220	228	3.03
21-31	8	2.30	85.7	0.903
31-32	4	0.180	186	1.96
31-41	8	0.720	26.8	0.282
41-42	4	0.360	373	3.93
41-51	8	1.57	58.5	0.616
51-52	6	0.42	61.1	0.643
51-71	8	1.63	60.7	0.639
70-80	6	0.38	55.3	0.583
70-72	10	1.98	24.8	0.261
62-72	4	0.41	425	4.48
72-82	6	0.73	106	1.12
72-73	8	1.20	44.7	0.471
63-73	4	0.10	104	1.096
73-74	8	2.01	74.9	0.789
64-74	6	0.97	141	1.48
74-75	8	1.10	41	0.432
65-75	4	0.12	124	1.31
75-76	8	1.41	52.5	0.553
66-76	6	2.20	320	3.37
76-86	4	1.21	1,250	13.17

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ing system. If they were too great, then an investigation of the second question would be required. Of course, it might be found here that no alternate arrangement was available for the conditions of the problem. If this were the case, then major changes in the system would be required.

The work entailed in searching for a modified system would consist of making educated guesses as to what changes in pipe diameters of what lines, or what few changes in rerouting of lines may be beneficial. These educated guesses would come from practical knowledge of the operations of the system and from previously recorded computer data.

With each change, flow and pressure measurements would again be taken. After several modifications, sufficient data would be available to ascertain whether slight modifications could remedy the situation or whether a major change in the system would be required.

Second study . . . This study was the evaluation of pressure variations. Here it was desired to see what source would be required under different load-pressure conditions, and further, to see how the loads were affected under these conditions. Another phase of this study was to see the effects of added loads on the system, or what pressures and flows would be had in replacing one load by another. (This was to simulate a well going dry, and its supply being furnished by a new well.)

The mechanics of computer operations here again involved changing flows at loads by merely changing the rheostat setting, and measuring the appropriate voltages (pressures). When the required voltages were obtained, the whole board was read. That is, the flow in each line and load was measured and recorded, as were the pressure drops across single lines and across various sections of the system. It is not always necessary to read individual line losses and flows; however, if done, the results can be very helpful in locating bottlenecks. In this particular problem it was found that one 4-in.-diameter pipe needed to be changed to a 6-in. line, as there was too much pressure lost in this section. A visual means to ascertain the same results is sometimes had by noting the brilliance of the fluistors.

Third study . . . This was to determine if there were any bottlenecks. This was discussed in the second study. Some of the factors to look into in this type of a study are:

1. Key pressure measurements.
2. Flows in each line.
3. Pressure losses in each line.
4. Pressure drops between sources, and their directions.

Use of McIlroy at MRI . . . The most common studies made have been those of water (fresh) and gas (low and high-pressure) distribution systems. In addition, however, such systems as salt water, steam, sewage, medium-pressure gas and gas gathering have been analyzed. In most cases each study has much use of nearly all the previously mentioned nine applications.

The picture of the complexity and size of the studies made can be realized from the sizes of the cities whose utility systems have been put on the computer. These cities are representative of a geographical range from Canada to South America, and have been those of populations from 10,000 to over a million.

From these statistics it can easily been seen that full advantage has been made of every component of the computer, plus tricks of the trade. The geographical range was mentioned to emphasize the topographical factor which enters into these studies.

Although the analyzer at MRI is relatively small (number of lines, sources, and loads), its capacity has

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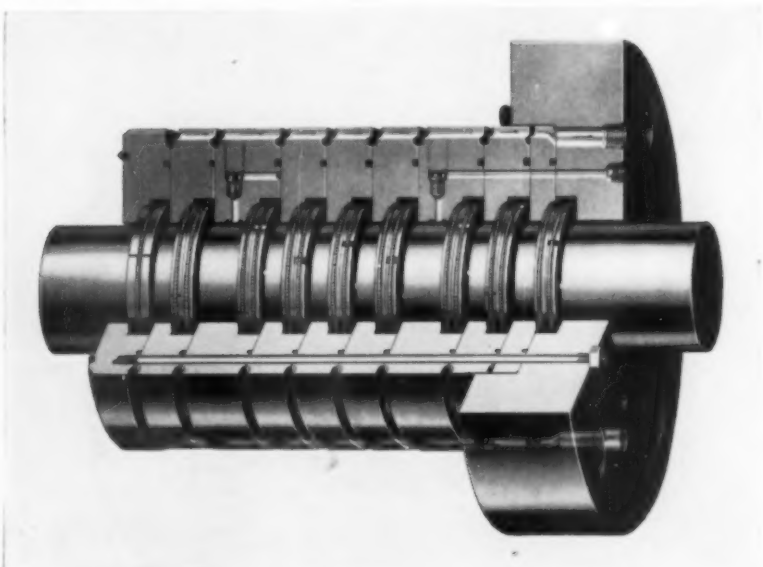

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been found to be sufficient for a wide variety of system sizes. This is due to the fact that a large network can be broken down into sections, and each section run as a problem. The over-all picture can definitely be had in this manner.

The tie between the section comes from establishing the best break points for the sections; and then when studying one section, key pressure and current requirements for its adjacent sections may be made. In many problems, simplifications required for certain engineering aspects help in reducing some line and load capacities.

Many of these network problems are now being calculated on digital computers. However, it is the author's opinion that the special-purpose McIlroy analyzer computer is an excellent tool for use on such distribution problems as have been discussed above. It is believed that there will be a constant increasing demand for this type of computer and that its field of application will definitely grow.

Appendix

The McIlroy pipeline network analyzer has basically two important fields of application in the study of pipeline network. These are flows where the fluid density is considered to be constant and where the fluid density varies. The empirical formulas which are generally used consider the loss function caused by fluid friction as varying as the flow rate to the 1.85 power or squared, depending on whether the fluid density is constant or variable.

The Hazen-Williams hydraulic formula which is used in water distribution problems as well as several formulas used for compressible fluid flows are given below. In addition symbols and notations commonly used are also given.

1. Variable density formulas:

(a) 1.85—power:

1. Fritzsche gas or steam:

$$Q = \frac{1.72}{\sigma^{0.462}} (T_o/P_o) \times [(P_1^2 - P_2^2)/(T\,l\,10^3)]^{0.538}$$

2. Panhandle gas:

$$Q = 0.01816E \times [(P_1^2 - P_2^2)/(TL\,\sigma^{0.854})]^{0.539} \times (T_o/P_o)^{1.079} \times d^{2.618}$$

(b) Square—law:

1. Weymouth high-pressure gas:

$$Q = 0.01806E\,(T_o/P_o) \times [(P_1^2 - P_2^2)\,d^{15/3}/(\sigma\,TL)]^{1/2}$$

2. Spitzglass high-pressure gas:

$$Q = 0.0469\ \{[d^5/(1 + 3.6/d + 0.03d)] \times [(P_1^2 - P_2^2)/(\sigma\,L)]\}^{1/2}$$

(c) Common relationship for use in (a) and (b) above:

1. The pressure-drop function, Z:

$$Z = P_1^2 - P_2^2 \text{ or } fP_1 - fP_2$$

where fP is pressure function in high-pressure studies.

2. Hazen - Williams hydraulic formula (constant density):

$$H = Ak_p\,Q^{1.85}$$

where H is the head loss, Q is the flow rate, and k_p is the head-loss coefficient of the pipeline.

The Hazen - Williams formula is commonly used in water distribution problems. Other formulas and relationships used in these studies are given below.

Symbols

- A = arbitrary constant to account for flow units
- B = volts per unit drop in the pressure function (conversion factor)
- C = Hazen - Williams smoothness coefficient
- d = inside diameter of pipe in inches
- E = efficiency constant
- G = amperes per unit flow rate (conversion factor)
- H = difference in pressure between two points, inches of water column
- I = current in amperes
- k_f = fluistor coefficient
- k_p = loss coefficient of pipe
- L = length of pipe in miles
- l = length of pipe in hilofeet
- M = loss coefficient of pipe per thousand feet
- P_o = base pressure in psia.
- P_1 = inlet pressure in psia.
- P_2 = outlet pressure in psia.
- Q = flow in thousand cubic feet per hour at standard conditions
- σ = specific gravity referred to air
- T_o = base temperature, °R.
- T_1 = flowing a gas temperature, °R.
- V = voltage
- Z = pressure-drop function
- μ = loss coefficient of pipe per mile
- θ = conversion factor to relate loss coefficient to fluistor coefficient

The analyzer operates essentially according to what one may term a form of Ohm's law:

$$V = k_f\,I^{1.85}$$

where V is the voltage across the fluistors terminals, I is the current through the fluistors, and k is the coefficient of the fluistor.

The electrical analogies to the Hazen-Williams formula are:

$$I - Q \qquad V - H$$

$$K - Ak_p$$

where:

$$k_p = Ml$$

and

$$M = \frac{5{,}830}{d^{4.87}\,C^{1.85}}$$

There are three conversion factors used for both the constant and variable fluid flows.

For constant density:

B = V/H volts per unit head loss.
G = I/Q amperes per unit flow rate.

$$\theta = k_f/k_p = A\,(B/G^{1.85})$$

Forr variable density:

B = V/Z volts per unit drop in pressure fraction.
G = I/Q amperes per unit flow rate.

$\theta = k_f/k_p = A\,(B/G^{1.85})$.

Values for the constant A for fresh water are:

Q	H — Psi.	H — Feet of water
U.S. g.p.m.	4.34×10^{-6}	10^{-5}
U.S. M.M. gal/d.	0.783	1.807
Hundreds of U.S. g.p.m.	0.0217	0.0501
Cu. ft./sec.	0.350	0.807
M.c.f./hr.	0.0327	0.0754
Imperial M.M. gal./d.	1.098	2.53
Imperial g.p.m.	6.07×10^{-6}	1.401×10^{-5}
Hundreds of Imperial g.p.m.	0.0304	0.0702

Equations for finding A for some of the formulas given above for variable density are:

1. Fritzsche:

$$A = 3.67 \times 10^4\,T\,\sigma^{0.86}\,(P_o/T_o)^{1.83}$$

and $k_p = Ml$, where $M = 10^6/d^5$

2. Panhandle:

$$A = \frac{1.658T\,\sigma^{0.85}}{10^3\,E^{1.85}} (P_o/T_o)^2$$

and $k_p = \mu L$, where $\mu = 10^6/d^{4.85}$

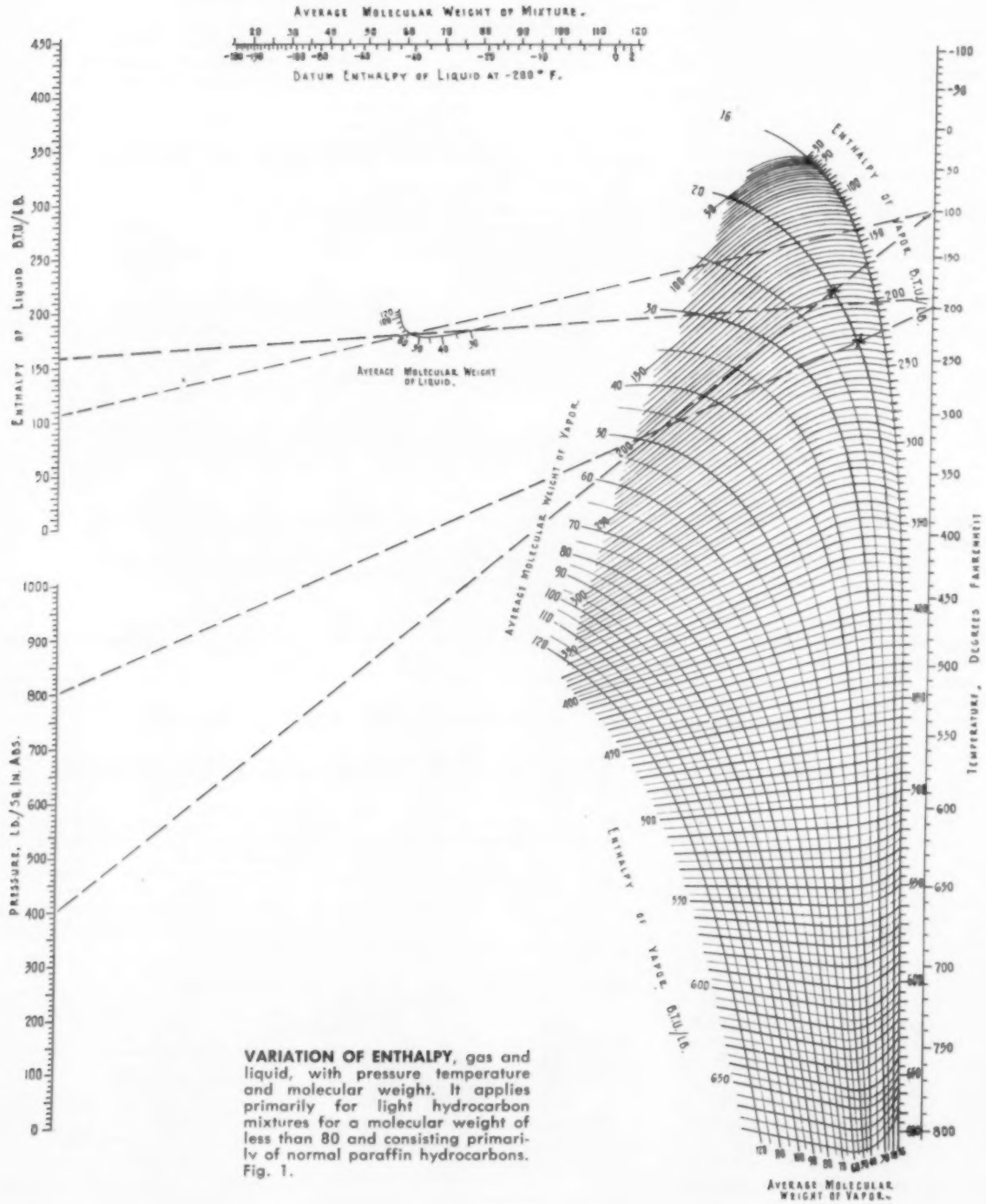
ELEMENTS OF FIELD PROCESSING—50

Change in enthalpy

. . . *using nomographic methods*

BY DR. JOHN M. CAMPBELL
University of Oklahoma

THE USE of enthalpy nomographs is convenient, particularly where the computations are time consuming and tedious. It is furthermore a convenient means of determining the effect of pressure on enthalpy at constant temperature. Therefore, in a process where both pressure and temperature change one may divide it into constant pressure and temperature steps as shown in Part 48.


Average Molecular Weight of Mixture.
Datum Enthalpy of Liquid at -280° F.
Enthalpy of Liquid, BTU/LB.
Average Molecular Weight of Liquid.
Average Molecular Weight of Vapor.
Enthalpy of Vapor, BTU/LB.
Temperature, Degrees Fahrenheit
Pressure, Lb./Sq. In. Abs.
Average Molecular Weight of Vapor.

VARIATION OF ENTHALPY, gas and liquid, with pressure temperature and molecular weight. It applies primarily for light hydrocarbon mixtures for a molecular weight of less than 80 and consisting primarily of normal paraffin hydrocarbons. Fig. 1.

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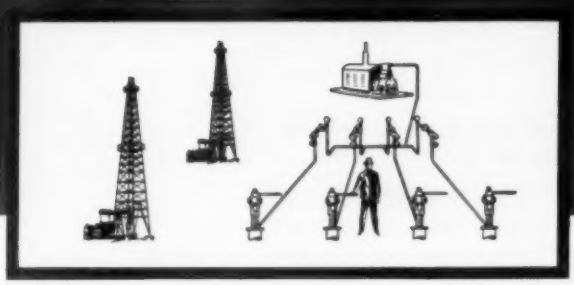

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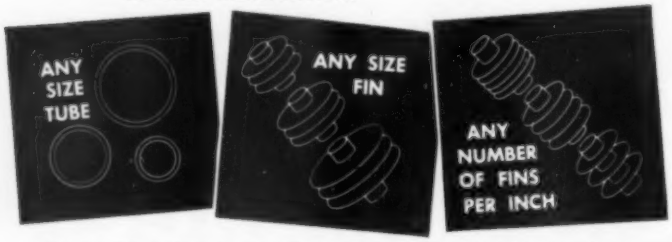

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Fig. 1 shows the variation of gas and liquid enthalpy with pressure, temperature, and molecular weight.[1]

Fig. 1 was derived primarily from a chart for pure hydrocarbons.[1] The latter is slightly more accurate but correspondingly more tedious. The use of molecular weight has been found to be generally satisfactory for lease processing.

The datum plane for the enthalpies is −200° F. The horizontal scale in the upper center of Fig. 1 is a correction device in order that the sensitivity of the nomograph might be better at higher enthalpies. The datum planes of the individual hydrocarbons are thus adjusted so that the lines of constant enthalpy in the middle of Fig. 1 are substantially straight.

This correction gives the enthalpy of the liquid at the datum versus the molecular weight. Instead of being necessarily zero it would be the value shown. This is largely academic for in the normal flowing system this correction cancels when applied to both the inlet and outlet streams.

No pressure correction is needed when working with liquid for the variation of enthalpy with pressure is negligible.

Example: Determine the change in enthalpy when heating 1,000 lb. per hour of liquid having a molecular weight of 60 from 100°-190° F.

Solution: From the upper portion of Fig. 1 straight lines are drawn through the two temperatures and the 60 mol. wt., yielding

$$H_2 = \textbf{160 B.t.u. per lb.;}$$

$$H_1 = \textbf{106 B.t.u. per lb.}$$

$$\therefore \Delta H = (1{,}000)\ (160 - 106)$$

$$= \textbf{54,000 B.t.u. per hr.}$$

The lower portion of Fig. 1 may be used to illustrate the variation of enthalpy with pressure and temperature.

Example: Determine the enthalpy change for a 0.69-sp. gr. natural gas in being compressed from 400 psia. and 100° F. to 800 psia. and 200° F.

Solution: Straight lines are drawn between the corresponding temperatures and pressures. A 0.69-sp. gr. gas has a molecular weight of (28.97) × (0.69) = 20. Where these straight lines intersect, the 20-mol. wt. line determines the respective enthalpies.

$$\Delta H = H_2 - H_1 = 235 - 195$$

$$= \textbf{40 B.t.u. per lb.}$$

Reference

1. Scheibel, E. G., Petr. Ref., 26, 3 (1947), 116.

CANADA'S DEEPEST TEST

sheds new light on foothills drilling

BY NORMAN S. MORRISEY
Drilling Development Editor

THE Central Foothills Agreement Group well, 6-4 Lambert Creek, is now the deepest well in Canada; operator finally plugged the well at a total depth of 15,195 ft. Previous depth record was held by a well offshore from Prince Edward Island, Owen Development Co. 1 Hillsborough, that reached a total depth of 14,696 ft. in 1942.

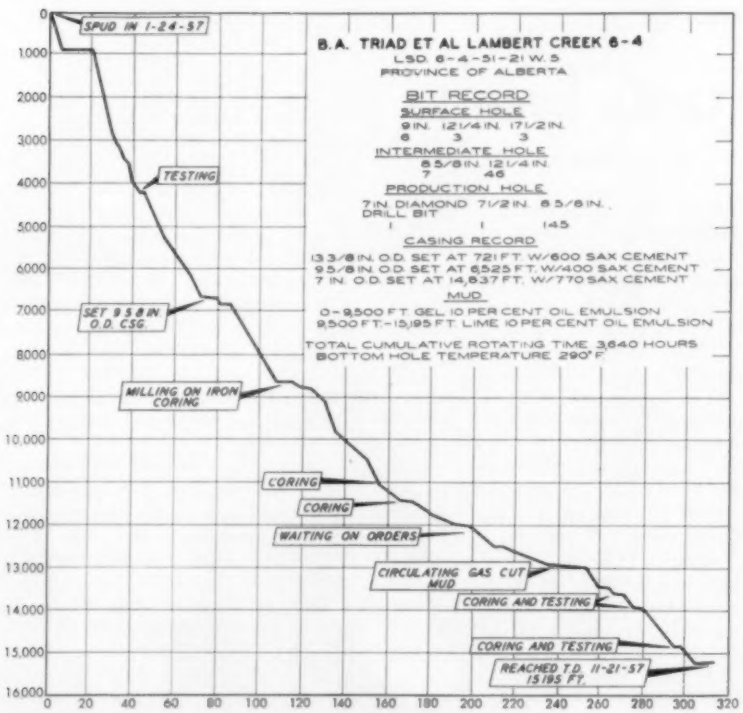
Expensive drilling, high exploration costs, and inaccessible locations put the Canadian foothills out of the reach of all but the fattest of exploration pocketbooks. Even major companies form drilling syndicates to reduce the individual costs.

The Central Foothills Agreement Group, sponsors of the Lambert Creek test, is formed of British American Oil Co., Ltd.; Triad Oil Co., Ltd.; Royalite Oil Co., and Sun Oil Co. British American was the operator.

TABLE 1 — IMPORTANT EQUIPMENT ON THE ARROW DRILLING CO.'S RIG 21

C-E Nb-42-5 block
B-J 4300 hook
C-E Type H swivel
C-E Type JACS rotary table
2—GP GXP Gardner-Denver pumps
1—10-in. Gardner-Denver mud mixing pump
Youngstown 4½-in. o.d. 16.60-lb. Grade "E" drill pipe
3—Waukesha LRDBSU diesel engines
Lee C. Moore 136-ft. mast w/12-ft. substructure

Blowout-preventer equipment:
12-900 CK Hydril
12-900 "SS" Cameron
80-gal. Hydril automatic accumulator.



DRILL LOG of B. A. Triad et al. 6-4 Lambert Creek sketches well's history as it was drilled to 15,195 ft.

Deepest test is a costly venture . . . The 6-4 Lambert Creek cost in the neighborhood of $1,100,000. The well was spudded January 25, 1957, and was abandoned February 3, 1958. Operator set 721 ft. of 13⅜-in. surface casing and 6,525 ft. of 9⅝-in. casing as intermediate string. Operator set 7-in. at 14,837 ft. and tried unsuccessfully to complete the well in the D-1 (Devonian).

Disaster threatened at 13,000 ft. during drilling operations when the well blew out. However, the crew managed to bring the well under control and tested 11 M.M.c.f. of gas from the Devonian D-1 zone.

Drilling contractor on Canada's deepest hole was Arrow Drilling Co. with its Rig No. 21. Table 1 lists the important equipment on the rig which is capable of drilling to 16,000 ft. Rig has an input of 1,250 hp. and is manufactured by Continental-Emsco.

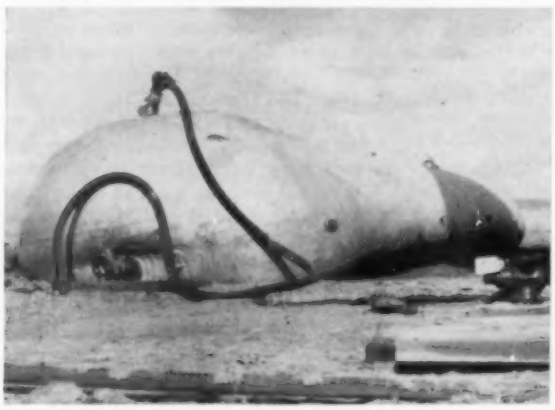
Foothills promising . . . Hazards are great in the Canadian foothills, but the oil and gas potential borders on the colossal. The fields are big and several are classed as major preserves. Pincher Creek operators had blocked out gas reserves valued in excess of ½ billion dollars even before the field was connected up to a gas pipeline.

Turner Valley, grandfather of all foothills fields, has already produced 112 million barrels and will ultimately give up an estimated 177 million barrels of oil. Other known foothills fields could develop into major oil or gas reserves.

Until recently, the primary drilling target was the Mississippian limestones, the Rundle or Madison equivalent. In 1956, however, British American established gas production in the Triassic. In late 1957 a possible new target was added, the D-1 zone of Devonian age. Shell Oil Co. has an indicated and significant D-3 discovery at its Panther River wildcat only 36 miles north of Banff. The over-all result is to give the foothills a much brighter outlook and presage more deep drilling in an already hot area.

1—**DEFLATED TANK** is unrolled on a level spot . . .

2—**RIG HANDS** prepare to fill the tank . . .



3—**WATER CIRCULATES** to prevent it from freezing . . .

4—**WATER IN TANK** is used for cementing operations . . .

Collapsible water tanks boon to wildcatters

BY NORMAN S. MORRISEY

DRILLING COMPANIES in the Four Corners area are taking a close look at the new collapsible 15,000-gal. water tanks. These tanks are made of lightweight rubberized fabric.

Exploration Drilling Co., Tulsa, has field tested one for the last few months and found its performance highly satisfactory. Principal advantage of the portable tank is the ease with which it can be moved, according to Lewis E. Andrews, assistant general manager, Exploration Drilling Co.

He cites one instance when a portable tank was on location in San Juan County, New Mexico. It had been used for additional water supply when the company ran an intermediate string of casing.

One of Exploration's other rigs in San Juan County, Utah, 130 miles away, lost circulation. In a matter of 4 hours, Exploration Drilling had the portable tank on location at the Utah well. The time and money saved in moving the tank quickly was considerable and, more important, the tank was on location where needed.

These portable tanks can be rolled up into a package 8 ft. long and only 2½ ft. in diameter. They weigh about one-tenth as much as a steel tank of comparable capacity. According to the manufacturer, Firestone Tire & Rubber Co., a collapsible tank can be moved 50 miles for $12.50 in typical Rocky Mountain country.

It costs $175 to move a steel tank the same distance. A small truck can carry seven of these tanks, representing a total capacity of 105,000 gal. A large semitrailer can carry only one 15,000-gal. steel tank.

Exploration Drilling Co. uses its tank for water storage in the event of blowouts or lost circulation. It is also used as a reservoir during cementing operations when temporary additional storage is needed.

The 15,000-gal. collapsible tank, often termed a "whale," is 47 ft. long, 11 ft. wide, and 5 ft. high when filled to capacity. In cross-section, the tanks are "D" shaped and have an internal system of flexible stabilizers. The latter prevent the tank from rolling on hilly terrain.

The tank is equipped with outlets, one at each end, so it is possible to circulate; this prevents freezing during cold weather. The cost of a 15,000-gal. tank is approximately $3,000.

The tanks prove their worth on wildcat drilling, particularly in areas such as the Four Corners where water must be hauled and water storage is a real problem. They can be hauled to a rig at a moment's notice if trouble develops.

Here's the most modern hook-wall packer yet!

Product No. 420-E

The NEW BAKER Model "E" RETRIEVABLE CASING PACKER

Drawing on the experience and know-how gained from 30 years of leadership in the field of design and development of high-performance retrievable squeeze tools, BAKER has combined many of the features from these tools with the simplicity of J-Slot operation to make possible this short, most modern of all hook-wall packers.

Only three feet long, the Model "E" Retrievable Casing Packer has the same rocker-type slips and proven dependable packing element used so successfully on BAKER retrievable squeeze tools. No drag springs to make a long, cumbersome tool. No slip tie-links or guide grooves to allow the slips to become stuck or cocked. No restricted bore to prevent running instruments through the packer.

Easy to run (just rotate to the right and set down) and easy to retrieve (just pick up the tubing) the BAKER Model "E" Retrievable Casing Packer is a model of high-performance in a small package.

See your BAKER man today for additional information on how the BAKER Model "E" Retrievable Casing Packer can solve your hook-wall packer needs.

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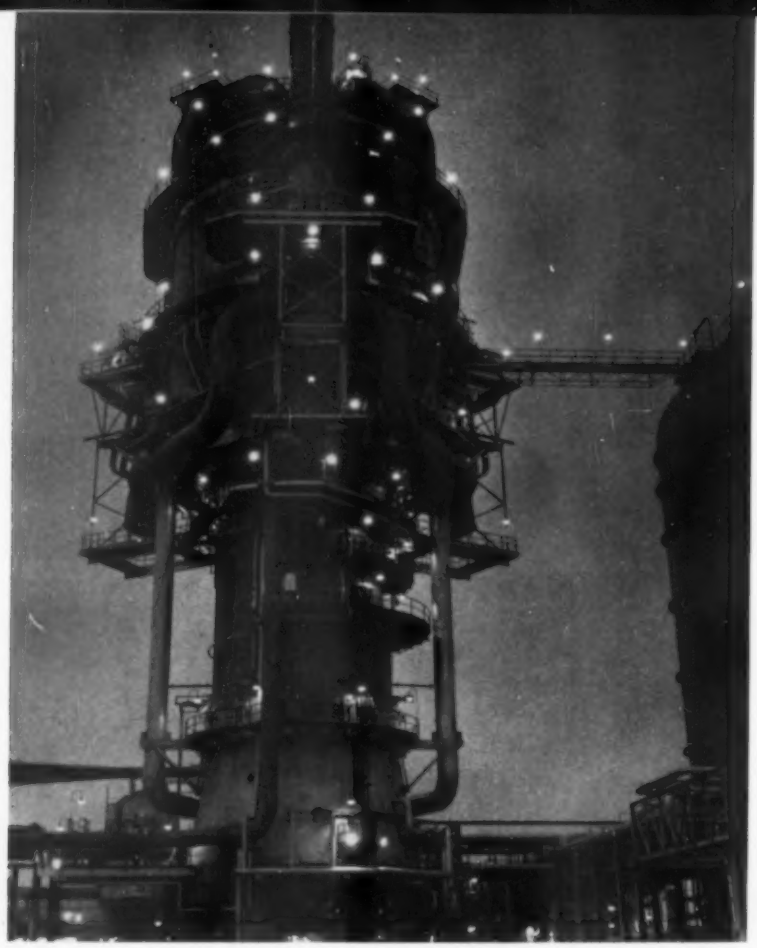


FREELY VENTILATED AREAS are relatively nonhazardous and are sometimes classified Class I, Division 2 (semihazardous). They can be illuminated with ordinary vaportight lighting. Fixtures of this type brighten the catwalks of Tidewater's Delaware refinery fluid catalytic cracker. They protect the lamp bulb, receptacle, and fixture electric wiring from dirt and moisture, and contain any sparks that might occur. Readings can vary from 5 to 10 ft.-candles for structures of this type.

ALLOW ENOUGH LIGHT for personnel to move about freely. These reactor stairways and platforms at Yorktown are illuminated to an intensity of 5 ft.-candles, enough light for personnel to walk or climb up and down easily. Vaportight lighting fixtures are staggered along the sides of the reactor to broaden the light pattern over unit.

REFINING

Let there be light

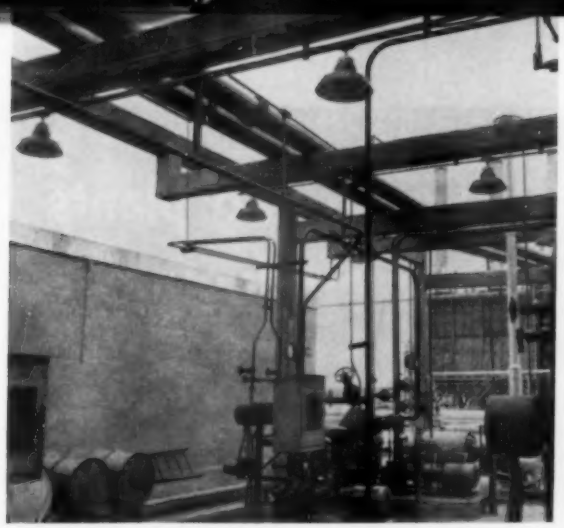
. . . the right kind, and at the right places, in your outdoor process area

BY JOHN B. CROSBY
Crouse-Hinds Co.

TO ACHIEVE good exterior lighting at refinery processing areas, be sure to accomplish this prime goal—give your men enough light to enable them to do their jobs at night as well as they do during the day.

Simple as this sounds, actually getting the right amounts of light in the right places isn't easy. The job of equipping processing or work areas of a refinery adequately and safely becomes complex when you consider the particular—sometimes unique—needs of each area.

Consider these factors, for instance. Areas vary in importance, activity, and types of equipment. Some are glutted with shadow-throwing overhead pipes, pumps, pump motors, stairways or catwalks; others contain



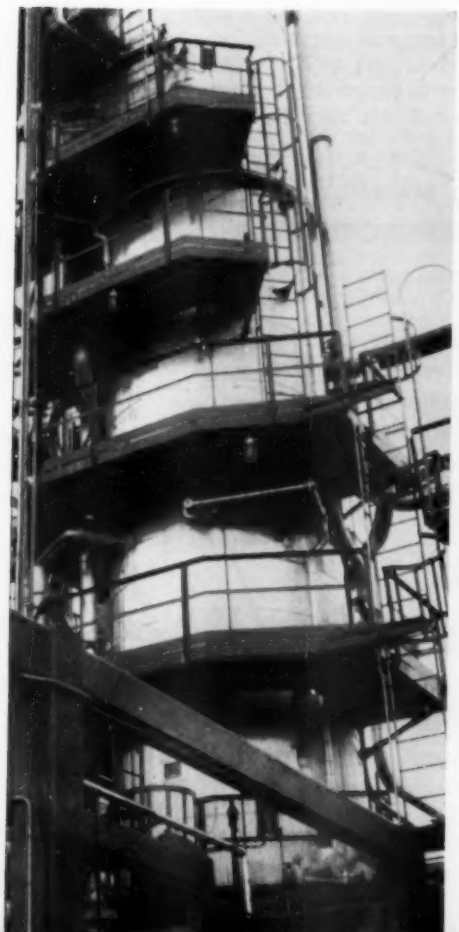
ALWAYS PUT ENOUGHT LIGHT where it is needed. To meet the tasks of monitoring instrument gages, checking for pump-bearing and valve leaks, and making maintenance adjustments, this pump-motor area at Yorktown has a lighting intensity of 10 ft.-candles. Lighting fixtures are rigged along undersides of concrete pipe supports.

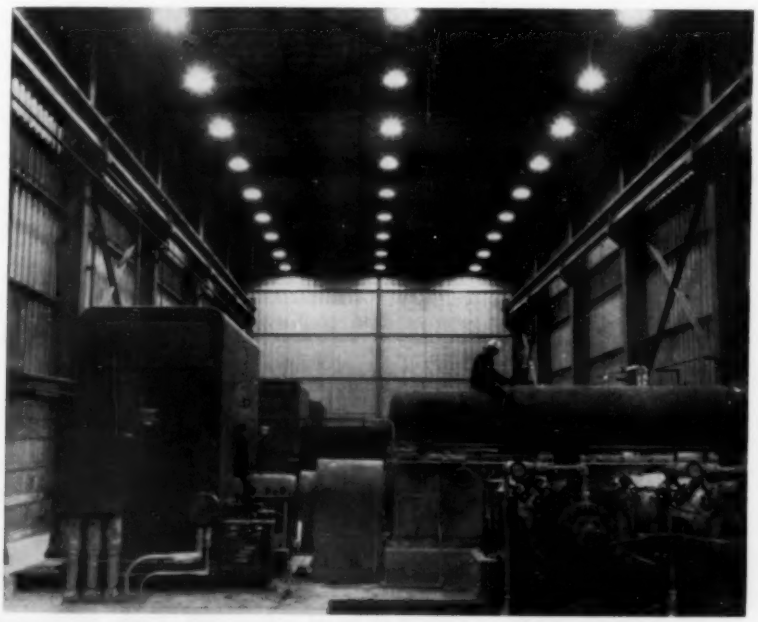
USE FLOODLIGHTS whenever it's possible. Five floodlights illuminating the pump area between a control house and the tank-storage areas at Yorktown. Far simpler to install than a quantity of individual lighting fixtures, these units produce approximately 5 ft.-candles of evenly spread light over an area of 350-ft. square.

only unloading gear, storage tanks, or roadways, where activity at night may be dormant and, consequently, the need for a great many lighting fixtures is far less. Hazardous zones require explosionproof lighting fixtures (Class I, Division 1 or 2). Nonhazardous areas use vaportight luminaires.

Lighting intensities for different sections of processing units call for anywhere from 1 to 30 ft.-candles which, in turn, can be obtained by using either incandescent, fluorescent, or mercury-vapor bulbs. Each of these types has its special advantages. Finally, floodlights sometimes do a better and less expensive job than lighting fixtures.

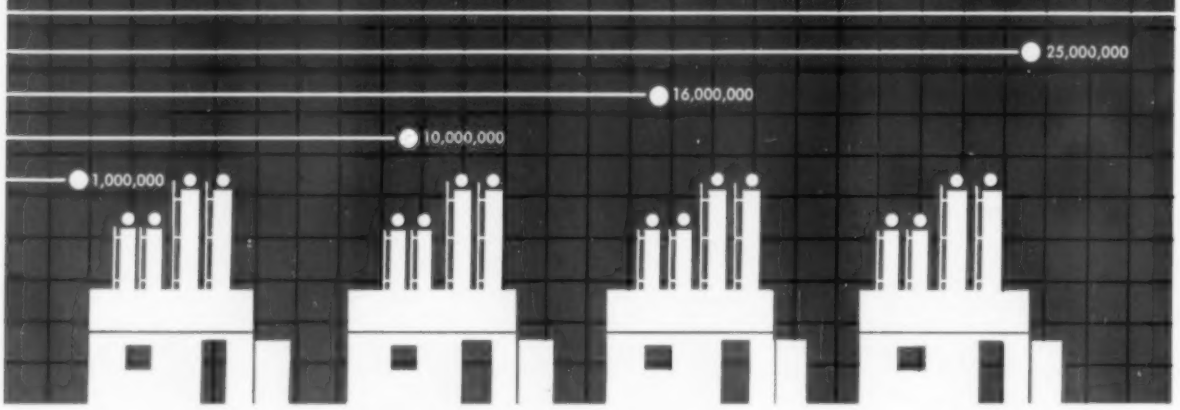
Using two new refineries as examples—Tidewater Oil Co's. new 200-million-dollar Delaware refinery, south of Wilmington, and Amoco's Yorktown, Va., refinery—the pictures show proper exterior illumination.





PROCESSING AREAS enclosed on three sides or more are Class I, Division 1 locations. Explosionproof lighting fixtures produce 25 to 30 ft.-candles of illumination over the floor of this compressor room at Tidewater's Delaware plant. These fixtures must operate at a temperature below the ignition temperature of gas-air or vapor-air mixtures that may be present. They are also strong enough to withstand repeated internal explosions without damage and tight enough to prevent the escape of flames or burning gases other than harmless, cooled exhaust gases.

RUSSCO gas processing plants grow with your gas production... ECONOMICALLY



A gas processing plant can be constructed on your lease by Russell Engineering Corporation to profitably handle as little as one million cubic feet of rich gas per day. Then as your production increases other plants can be quickly added to process any increased quantity of gas. As production declines, the portable Russco plants can be moved to a new site at minimum cost.

Russco plants are now operating from New Castle, Wyoming, to Kingsville, Texas, with minimum attendance. These installations operate at top efficiency in temperatures ranging from 40° below zero to 105° in the shade. Why not find out for yourself how *Russco specialized processing equipment* can benefit your operation.

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2. **Russco Thermo-Syphon Reboiler:**
   A direct-fire reboiler *proven safe* in over one million hours of heater use. Standardized design makes this a low cost unit, completely eliminating hot oil circulating pumps.
3. **Russco Air Cooled System:**
   Water problems are completely eliminated with the Russco water-free system.
4. **THE RUSSCO SERVICE POLICY:**
   At Russell Engineering Corporation *service* is always *first*. Russco engineers help survey your problems, then design and construct your plant to meet your individualized needs. Russco engineers help you to maintain maximum plant efficiency after completion.

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By W. L. Nelson, Technical Editor

Effect of crude gravity on refining cost

In your Costimating article No. 31, you show the effect of octane number and lubricating-oil production on the cost of refineries. What about the gravity of the crude oil? F.T.S.

Costimating No. 31, "How Complexity of Operation Affects Refinery Cost," May 27, 1957, p. 155, was based on the average gravity of U.S.A. crude oil, namely, 34.5° API. It is obvious that crude-oil gravity vitally affects the cost of a refinery because of the larger amounts of distillable or workable materials in the high-gravity oils.

In order to evaluate the effect of gravity, it is necessary to fix several other variables, especially the general type of processing and the octane number of the plant gasoline. The plants of Table 1 are all relatively simple plants and the octane number of the gasoline is 86-(research) with 2cc TEL. Venezuelan crude oils were used as the basis so that crude oils of consistent properties from 15° to 40° API were available. Such oils contain relatively high-octane-number straightrun gasoline and produce cracked gasolines of somewhat high-octane number. In addition, refineries that were serving world trade were contemplated and this means relatively low yields of gasoline (only 39 per cent of the crude was catalytically cracked for the 35° API crude oil whereas 50 per cent was cracked in Costimating No. 31). These several factors caused the plant cost to be lower in Table 1 than in Costimating No. 31 ($435 per bbl. here but $480 in Costimating No. 31 when producing 86-octane gasoline).

At this octane level (86 research) thermal cracking can be used for crude oils in the gravity range of 15°-35° API. At about 35° API, it is necessary to adopt catalytic cracking. If pool gasoline higher in octane number than 86 is required, catalytic cracking is also necessary for the lower gravity crude oils.

If these refineries were used to supply world trade, they would probably need extensive tanker terminals and this would add to the cost.

Effect of density on tanker rates

In connection with your answer for January 13, 1958 (Product Prices Throughout the World), what is the relation between DWT and barrels of capacity with reference to tankers and deviations due to density of product under consideration? C. S.

The spot tanker rates that are published by The Oil and Gas Journal and other publications are not affected in any direct way by the size (dead-weight tons, DWT) of tankers. Tanker operators compete with each other and arrive at competitive tanker rates, but this only means that the larger or newer tankers make a larger profit than old or antiquated equipment. Indirectly, of course, the rates charged by tanker owners are affected over the years by the type or size of the tanker fleet available at each date.

Rates are stated on a basis of long or shippers' tons, i.e., dollars (or Sterling, etc.) per 2,240 lb. Thus if the oil is light, such as gasoline, more barrels are contained in 2,240 lb., and the barrel rate is cheaper than for heavier materials. The weights of common materials are about:

	lb. per bbl.	bbl. per long ton
Gasoline	257	8.72
Kerosine	285	7.85
30° API crude oil	306	7.35
20° API crude oil	327	6.85
Residual fuel oil	348	6.44

Thus, for the standard USMC rate for Gulf-U.S.N.H. of $2.85, the cost of shipping 30° API crude oil would be 2.85÷7.35 or 38.8 cents per barrel, whereas residual fuel would cost 2.85 ÷ 6.44 or 44.2 cents per barrel. However, gasoline could not ordinarily be shipped for 2.85 ÷ 8.72 or 32.7 cents per barrel because clean tankage is not usually available. The rate varies, of course, but it usually is about 15 per cent higher for clean tanks, which means about 37.6 cents per barrel for the shipment of gasoline.

TABLE I—PROCESSING EQUIPMENT USED IN EVALUATING THE EFFECT OF CRUDE OIL

	Capacity of process units, fraction of crude capacity						
	15° API thermal cracking	20° API thermal cracking	25° API thermal cracking	30° API thermal cracking	35° API thermal cracking†	35° API Catalytic cracking	40° API Catalytic cracking
Desalting	1.00	1.00	1.00	1.00	0.50	0.50	0.50
Topping	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Thermal cracking	0.39	0.40	0.41	0.40	0.43	.....	.....
Catalytic cracking	.....	.....	.....	.....	.....	0.39	0.37
Catalytic reforming	0.30	0.075	0.117	0.172	0.21	0.028	0.06
Polymerization	0.014	0.015	0.016	0.017	0.019	0.021	0.021
Sweetening, TEL, etc.	0.276	0.342	0.391	0.472	0.57	0.401	0.445
Other treating	0.15	0.12	0.14	0.14	0.20	0.20	0.22
Storage, bbl.—large	40	40	40	40	40	40	40
small	24	27	30	34	34	34	38
Steam, lb. per hr.	4	5	5	6	7	7	8
Offsite costs, %	38	39	40	41	42	42	43
Refinery cost, 1946, $/bbl.							
30,000 B/D	$276	$316	$354	$395	$438	$435	$456
100,000 B/D	$232	$268	$304	$344	$387	$384	$405
Refinery cost, 1956							
200,000 B/D	$400	$480	$538	$615	$710	$695	$756
Dollars per bbl. gaso. (30,000 B/D)	$1,000	$925	$905	$835	$770†	$1,080	$1,025

*Catalytic cracking not needed for 86 octane number with 30° and lower API-gravity crude oils.
†Severe catalytic reforming, and viscosity breaking of a 20 per cent residue. The octane number is only 84 rather than the 86 required here.

BETHLEHEM at BEAUMONT

Pioneer

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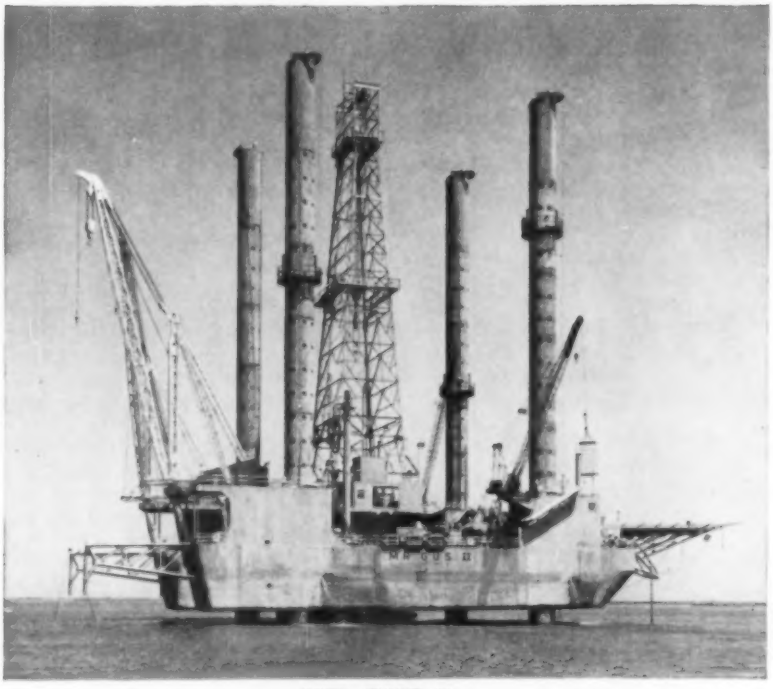

MR. GUS II
Platform 260′ x 104′ x 22′ Slot Length 57′ Width 50′ Sinking Depth 150′
Owner: C. G. Glasscock Drilling Co.

RAY TERRY
Hull 215′ x 52′ x 14′6″ Slot Length 90′ Width 11′ Sinking Depth 14′
Owner: Natural Gas and Oil Company

JIM WOODRUFF
Platform 190′ x 150′ x 12′ Slot Length 37′ Width 32′ Sinking Depth 75′
Owner: Penrod Drilling Company

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Baltimore Harbor — Beaumont, Texas
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BY W. L. NELSON
Technical Editor and
Petroleum Consultant

Fuel and steam required in average U. S. refinery

TABLES 1 and 2 of Process Costimating No. 8 (April 14, 1958, p. 129) permit a check of the heat actually used in an average 1955 refinery. Table 1 on this page shows the actual average capacities of various process units. When the heats required (from Process Costimating No. 8) for all of the operations are summed, the total B.t.u. required per barrel is 473,900, and the amount of steam is 183.4 lb. In addition to the process and power steam used in processing (the 183.4 lb.), other steam is also needed for the heating of buildings, shops, tanks, etc., and some is lost as condensate during delivery. Finally, the exhaust steam from small reciprocating and turbine driven pumps is used again, resulting in a live-steam requirement of about:

	Lb./bbl.
Steam required by process units	183.4
Add 30% for general transfer, heating, shops, etc.	238.0
Add 9% for condensate losses	260.0
Steam reused as exhaust steam 50%	130.0
Live steam required	130.0

Thus, the total heat required per barrel checks very well with the actual total for U. S. plants shown in Table 1 of Process Costimating No. 4 (March 17, 1958, p. 190), namely, 698,000 B.t.u. per barrel:

	B.t.u./bbl.
Process heat (Table 1 here)	= 473,900
Live steam 130 × 1,700	= 221,000
For generating 1.6 kw.-hr./bbl. 1.6 × 75 × 250	= 30,000
	724,900
Less credit for waste-heat boiler	= 33,500
Total heat required	= 691,400

Of this heat (691,400 B.t.u.) as much as 450,000 B.t.u. is derived in some plants by the burning of refinery gases (crude, cracking, reforming, etc.) and acid sludge. Thus, the heat obtained from purchased gas (or salable residual fuel) amounts to only 250,000-350,000 B.t.u. per barrel.

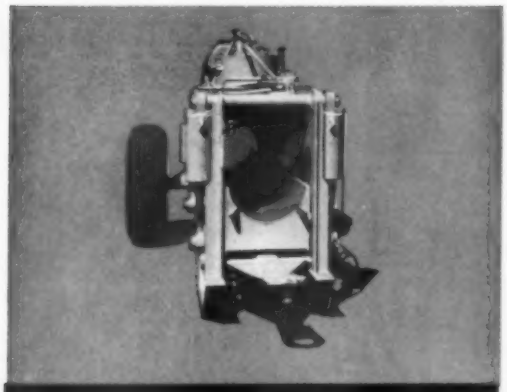
SCHEDULE—FUEL AND STEAM REQUIREMENTS

No. 4—March 17: Price and Cost of Fuel
No. 6—March 31: Fuel Costs (Foreign)
No. 8—April 14: Major Process Units
No. 9—April 21: Average U. S. Refinery
No. 10—April 28: Effect of Crude Oil Gravity
No. 11—May 5: Effect of Completeness of Refining
No. 12—May 12: A Lube-Oil Refinery
No. 13—May 19: Steam and Electricity

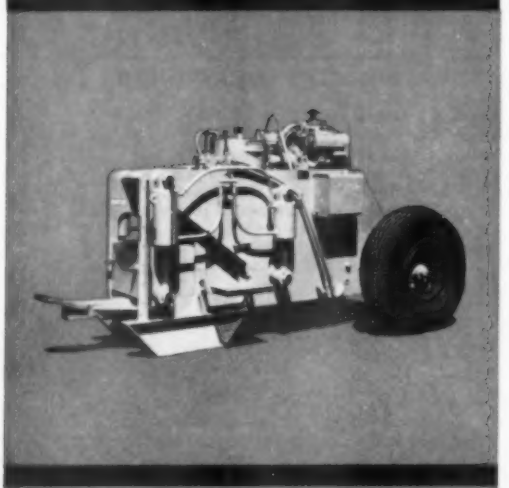
TABLE 1—APPROXIMATE FUEL AND STEAM REQUIRED IN PROCESSING AVERAGE U. S. CRUDE OIL
(34.5° API, 0.80% S) in a 30,000-bbl. per day plant (1955)

Types of major plants—	Capacity relative to crude cap. (%)	Heat required, B.t.u.* Per bbl.* feed	Heat required, B.t.u.* Per bbl. crude	Steam required, lb.* Per bbl.* feed	Steam required, lb.* Per bbl. crude
Topping and desalting	99.6	61,000	60,700	48	47.8
Reforming:					
Thermal	4.0	165,000	6,600	20	0.8
Gas engines†	†2.0	12,000	240	...	...
Catalytic	10.5	320,000	33,600	75	7.8
Thermal cracking:					
Two-coil	8.0	480,000	38,300	45	3.6
Visbreaking	10.0	190,000	19,000	30	3.0
Catalytic cycle	6.0	400,000	24,000	40	2.4
Gas engines†	†12.0	15,000	1,800	...	...
Catalytic cracking‡	39.4	615,000	242,000	85	33.5
Catalytic cracking gas engines†	†13.0	33,000	4,300	...	...
Polymerization	1.6	190,000	3,000	75	1.2
Alkylation	2.8	12,000	340	680	19.0
Light oil treating	25.0	.....	.....	30	7.5
Lube mfr. (3.6% lubes):					
Distillation and rerunning	14.0	170,000	23,800	150	21.0
Solvent extraction	7.2	142,000	10,200	130	9.4
Solvent dewaxing	7.2	.....	.....	300	21.6
Lube finishing	3.6	157,000	5,600	100	3.6
Wax finishing	0.4	105,000	420	300	1.2
Total			473,900		183.4

*Process Costimating No. 8, April 7, 1958, p. —. †Assumed that 50 to 67% of the compressors are motor driven. ‡Heat includes vacuum for fluid units but no flashing required for air-lift units.



CINCH



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- *MOVES ANYWHERE - only 6'8" wide*
- *SIMPLE HYDRAULIC OPERATION*
- *COMPACT DESIGN*
- *SCRATCH-FREE CONTROLLED BENDS*
- *TROUBLE-FREE MAINTENANCE*

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Crose offers two additional Cinch models for bending pipe 16"-30" and 22"-36" in diameter.

On the Job

PIPELINING

BY M. L. BARRETT, JR.
Shell Oil Co.

Four-way, four-part, two-position

Bidirectional prover can solve metering problems

INLET AND OUTLET connections and the four-way valve are shown in Fig. 1. A portion of the threaded liquid-inlet line on one end of the cylinder is also shown, by means of which adjustability of the displaced volume of the cylinder is obtained.

This latter feature permits accurate adjustment of the stroke of the piston and enables a very accurate calibration of the prover to deliver an exact 50 gal.

Paper presented at ASME petroleum division annual conference, Tulsa.

This was done by means of displacing fuel oil from the cylinder into a certified 50-gal. test measure. The lock nuts controlling the volumetric-adjustment pipe have been sealed in position by means of a lead-wire seal and the displacement is consistently within 3 cu. in. of 50 gal.

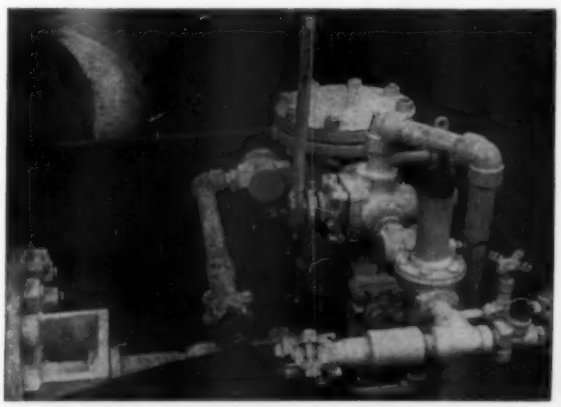
The prover is intended to remain full of the test liquid and is provided with excess flow valves, pressure relief valves, thermometers, pressure gages, vapor vents, and so on.

The expansion chamber, which provides the necessary 15% vapor space only when the unit is in transit, and a protective hood over the top qualify the prover for transportation over the public highways when full of liquid.

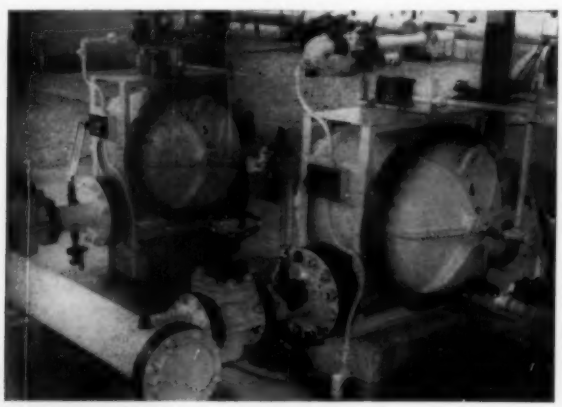
In operation, the inlet hose to the prover is connected to the meter to be proved and the discharge hose of the prover to the fill connection of the supply vessel.

In Fig. 2 the meter-delivery pump is started and the piston driven to either extremity of the cylinder where the liquid flow through the meter is automatically and completely stopped. The four-way valve is manually repositioned to its alternate position, which reverses the direction of flow of liquid through the cylinder and drives the piston to the other extremity of the cylinder.

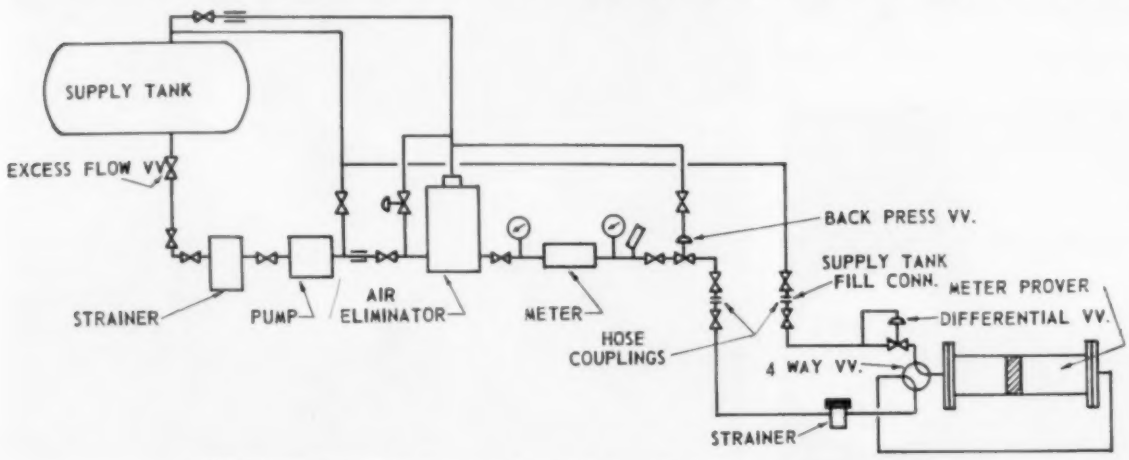
During the first two or three cycles of the piston from one end of the cylinder to the other, the proper back pressure is adjusted at the differential valve and the vents at each end of



BIDIRECTIONAL free-piston-displacement prover. Fig. 1.



PIPELINE METER, with solenoid-actuated registers. Fig. 3.



SCHEMATIC operating diagram of a free-piston-displacement prover. Fig. 2.

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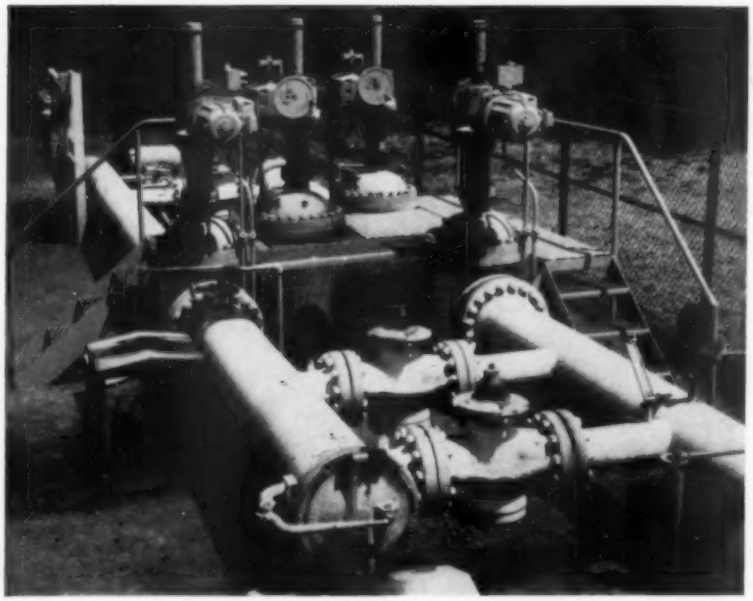


SCRAPER-LAUNCHING barrel. Fig. 4.

the cylinder are blown sufficiently to assure that no vapor remains inside the cylinder.

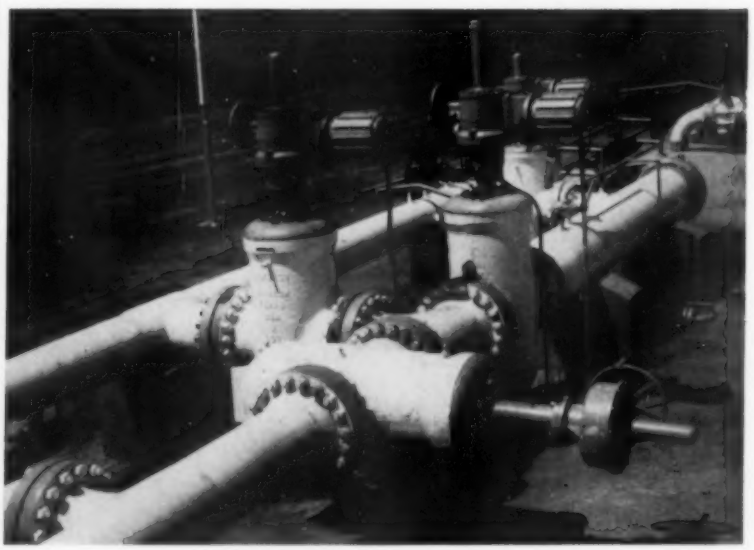
With the piston at either end of the cylinder, a meter reading is taken and the four-way valve moved to start a displacement of 50 gal. of liquid. When the piston stroke is completed there is an automatic stoppage of all liquid flow, assuring a delivery of exactly 50 gal.

At this point the final meter reading is taken and the meter accuracy may be computed. The operator may rapidly make as many proof runs as he desires simply by changing the position of the two-position, four-way valve manually.

The advantageous features of this bidirectional displacement prover may be summed up as follows:

1. It can prove meters on any type of liquid but is peculiarly adapated to meters operating on vapor pressures considerably higher that atmospheric such as butane, propane, and so on.

2. The test liquid is never permitted to pass from its liquid phase into its vapor phase thereby eliminating any errors which might result from evaporation or vaporization.



SCRAPER-RECEIVING barrel. Fig. 5.

3. The mechanical determination of the volume of the test draft is very accurate and eliminates human errors.

4. Temperature effects on the test draft are considered of no practical significance because of the rapidity with which meter tests can be made.

5. A meter can be tested at its normal operative flow rate and pressure and the flow rate will remain constant from the beginning to the test draft.

6. One man can operate easily and rapidly and there is no need for auxiliary power or a pump to remove the test liquid from the prover.

7. No charts, graphs, vapor tables, or other technical data are required and the calculations are quite simple.

8. The prover has a high degree of accuracy and the reproducibility of test results is considered excellent.

9. The equipment may be made permanent or portable and can be constructed with delivery capacities other than 50 gal.

The unidirectional free-piston-displacement proving method was inaugurated by Shell Oil Co. in 1952 and there are 12 such installations in its pipeline system for proving pipeline meters such as those shown in Fig. 3. Most of these installations are capable of being operated and proved at 5,200 b.p.h.

This system has frequently been dubbed the "measured mile" and is an entirely closed, volumetric proving system for determining the accuracy of meters "on the fly." It consists of a relatively straight section of line either upstream or downstream from the meters, known as the "meter-prover section," which actually is the prover tank.

Fig. 4 shows a type of scraper-launching barrel by means of which a scraper or piston can be passed through this section to displace the precalibrated volume between its extremities.

Meter-proving counters on the meters are electrically triggered to register only during the time when the scraper is passing through the meter-prover section.

The scraper is caught and removed from the pipeline by means of the scraper-receiving barrel shown in Fig. 5. In some instances it may be desirable to loop the pipeline meter-prover section, in which case this scraper-receiving barrel is installed near the site of the meters and adjacent to the scraper-launching barrel.

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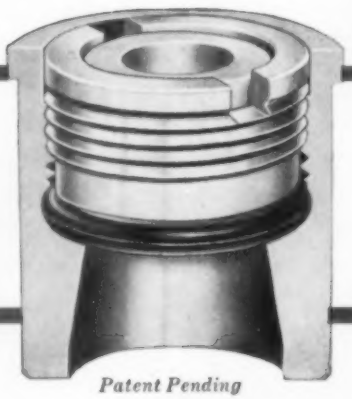

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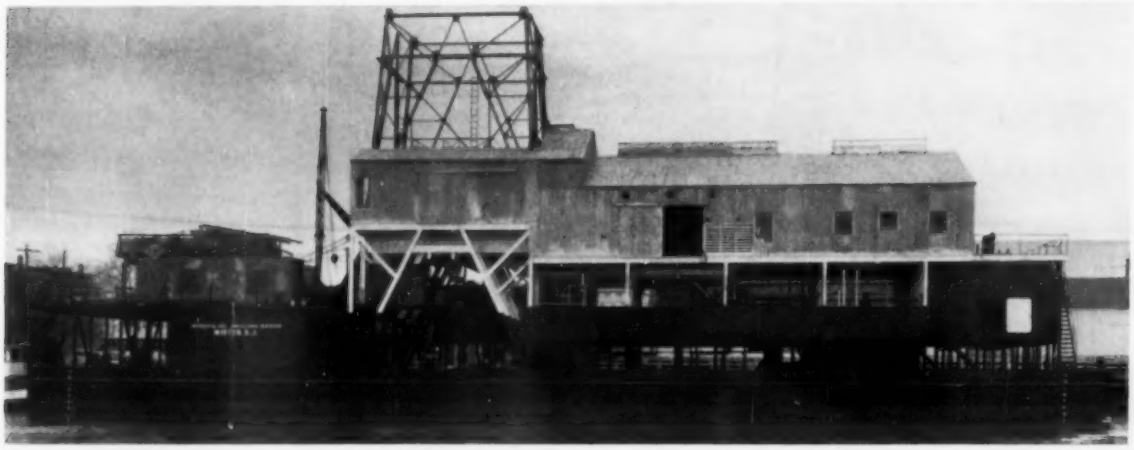

"MISTER E. J." starts journey from Orange shipyard to first drilling job in coastal Louisiana's marshlands.

New barge is designed for inshore drilling

NEWEST ADDITION to South Louisiana's massive array of large drilling rigs is a powerful barge assembly Nicklos Drilling Co., of Houston, is operating in the coastal marshland area of Vermilion Parish.

The barge, now on its first job, was commissioned recently at Levingston Shipbuilding Co.'s yards at Orange, Tex., where it was built and equipment assembled.

It is christened "Mister E. J." in tribute to the late E. J. Nicklos, founder of the drilling company.

Nicklos Drilling Co. operates the rig for McNisco, Inc., an affiliated firm, of which Don E. McMahan is president; Gordon E. Nicklos, vice president; and K. R. Simmons, vice president in charge of operations.

The new assembly brings to 10 the number of rigs Nicklos Drilling Co. now is operating on the Gulf Coast. They include offshore, inland water, and land rigs. The new assembly is designed for drilling mainly at inshore and other protected water locations.

The barge is of the conventional submersible type. The slotted hull is 180 ft. long, 50 ft. wide, and 12 ft. deep.

Drilling facilities include an Ideal 130 draw works and two Ideal G-1000-B mud pumps, powered through compound by three Superior PTDS-8 diesel engines. A third mud pump, an Ideal C-250, is separately powered by another engine of the same type and size. The assembly uses a Lee C. Moore 140-ft. 1,100,000-lb. load-capacity derrick with a 30-ft. base. Rotation is with a National 27½-in. rotary.

Complete and modern galley and dining-room, bunk-room, and change-room facilities are provided.

Who's getting the drilling contracts?

Arnold Well Service Co., Corpus Christi, is on a new 5,000-ft. drilling job 3 miles west of Mathis, in northwestern San Patricio County, South Texas. It is a contract operation for Louis H. Weltman, also of Corpus Christi. Location, 1 Collins, is about a mile northwest of gas production in Miller Ranch field.

Rimrock-Tidelands, Inc., New Orleans, has the contract on the Lower Cretaceous test Vaughey & Vaughey, of Jackson, Miss., are starting in southern Walthall County, South Mississippi. The location, at 1 Pigott, in 6-1n-12e, is 6 miles west of the deep Dexter field, nearest production, which Skelly Oil Co. and Kin-Ark. Oil Co. discovered last year. The Vaughey test is set up to go to 10,400 ft.

Circle Drilling Co., Lake Charles, La., has taken on two new deep drilling jobs in southwestern Louisiana's coastal sector. Both are wildcats. One is 15,000-ft. test for Frankfort Oil Co. at 1 Lacassine, about 4½ miles southeast of Chalkley field, in northern Cameron Parish. The other is a 12,500-ft. test for Texas Gas Exploration Co. at 1 Marceaux, about 1½ miles east of the Kaplan area, in Vermilion Parish.

Rimrock-Tidelands, Inc., New Orleans, has the contract for a 9,800-ft.

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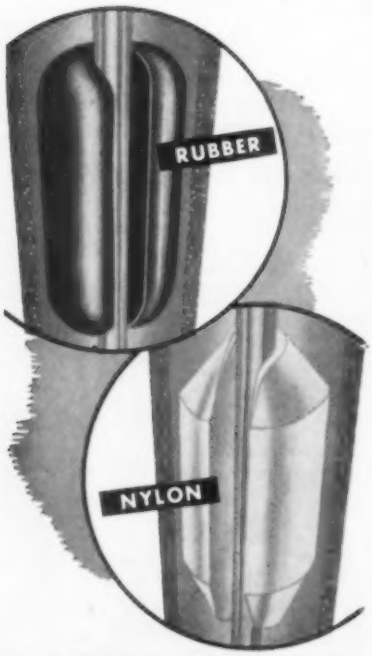

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wildcat Union Producing Co. is undertaking on its State Lease 3163, in Lake Pontchartrain, offshore from Orleans Parish, Louisiana.

Carnes W. Weaver Drilling Co., Houston, is on a new deep wildcat operation in the Bancroft area, near the western edge of Beauregard Parish, southwestern Louisiana. It is a contract job for Siboney Petroleum Co. Location, at 1 Columbia, in 9-6s-13w, is about a mile from production. It is slightly less than 2 miles from the Texas line (Sabine River).

Viking Drilling Co., San Antonio, has a new contract operation going in the Dunn area of South Texas' active Live Oak County. Drilling is for Peet Oil Co., whose location, at 1 Dunn, is about ¾ mile from nearest production, a gas well. Operators plan an 8,600-ft. test.

Deckard Drilling Co., Shreveport, has a rig on a distant wildcat location in southern Dallas County, South Central Alabama, where it is drilling a 5,000-ft. Smackover test for Marion Buchanan, of Brandon, Miss. Its location is more than 65 miles from the nearest field. It is in an area, on the Dallas-Wilcox county line, where Seaboard Oil Co. has done some exploration. Spot location, at 1 Hudson, in 35-13n-9e, is just south of Tilden, and about 9 miles northeast of Camden, county seat of Wilcox County.

Win-Hawkins Drilling Co., Houston, has another wildcat operation scheduled in the Lake Callebasse area, in southeastern St. Bernard Parish, on Louisiana's east coast. This one is for Hellenic Oil & Gas Co., whose location is offshore, in the lake. The contractor has just completed the drilling of two wildcats for Republic Natural Gas Co. in the immediate area. The first was dry at 9,481 ft., and the second at 8,667 ft.

Penrod Drilling Co., Shreveport, is drilling the new deep well Union Oil Co. of California is putting down in the north extension area of Alta Loma field, in Galveston County, Texas Gulf Coast. Its location is about ½ mile northwest of Alta Loma townsite at 1 Hanson. Permit depth is 13,000 ft. This is Union's first well in this area.

Bilbo-Redding Drilling Co., Houston, has a rig running on a deep wildcat operation about 3 miles west of oil production in Old Ocean field, in Brazoria County, Texas Gulf Coast. It is drilling for F. W. Carr and A. C. Sien, Jr. Hole already is well down on a 10,000-ft. permit.

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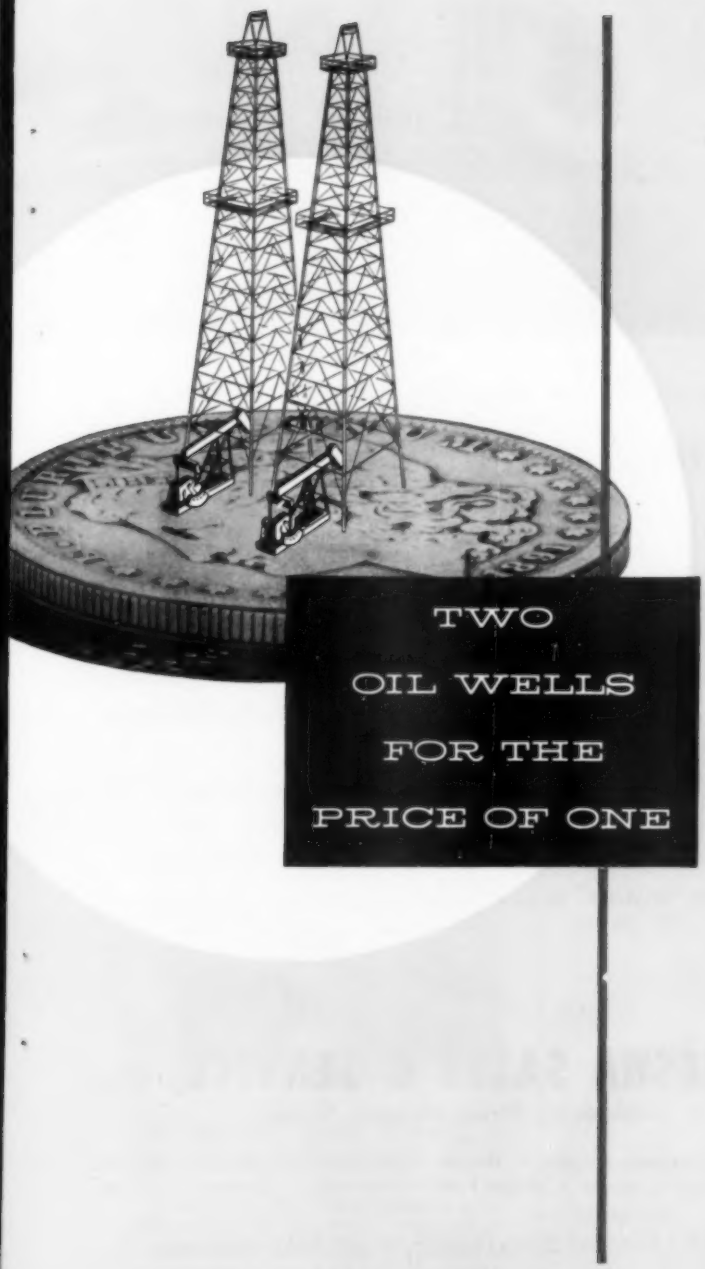

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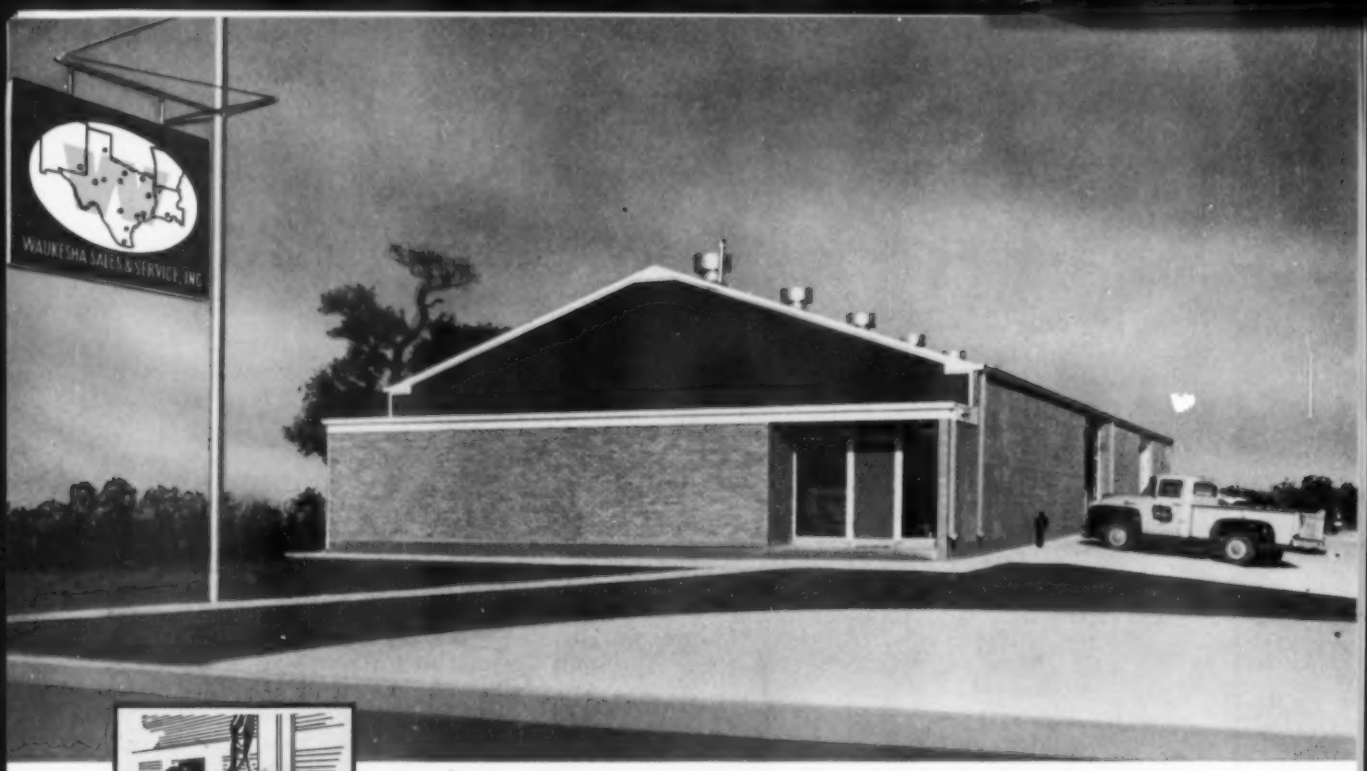

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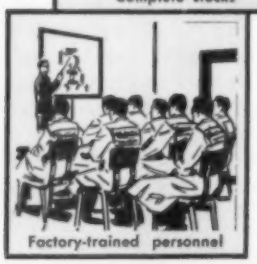
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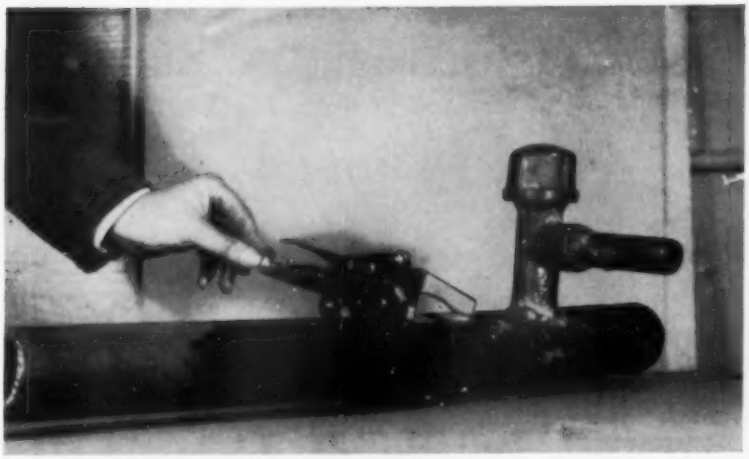

Lineup clamp speeds welding jobs

The lever-grip lineup clamp is used for welding together lengths of pipe and for making tie-in welds. It holds the pieces of pipe being joined in alignment during the welding operation.

The action is such that it is unnecessary to hold the clamp once it is attached to the ends of the pipe, the maker reports. It can be quickly installed, removed, and adjusted to handle pipe sizes of ¾ through 2 in., the maker adds. **Write or call: A & H Engineering Co., 1425 Campbell Street, Glendale, Calif., for details on lever-grip lineup clamp.**

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Reinforced Epoxy Pipe Available for 500 Psi.

The new corrosion-resistant reinforced plastic pipe has a longitudinal tensile strength of 40,000 psi. and a circumferential of 80,000 psi. With a weight one-eighth that of steel, it comes in 2 to 12-in. diameters.

Called Bondstrand, the pipe comes in rigid 20-ft. lengths with ends plain, flanged, or bell-and-spigot. Other lengths, as well as diameters up to 40 in., are available on special order. It may be used for water, hydrocarbons, salt solutions, and solvents. Potential uses include cooling-tower piping, salt-water lines, tanker-product lines, and refinery piping.

Two standard series are in production. One has a nominal working pressure of 250 psi. (Bondstrand 150). The other is rated at 500 psi. (Bondstrand 500). Both have a 10-to-1 safety factor. **Write or call: Amercoat Corp., 3809 Firestone Boulevard, South Gate, Calif., for details on Bondstrand pipe.**

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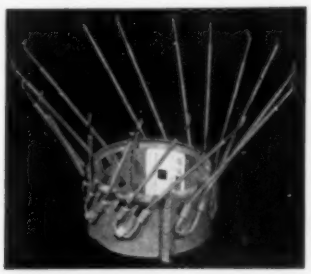

Scratcher Features Coil-Spring Fingers

On the new BJ Red Top scratcher, coil-spring steel fingers enclose the wire-scratching elements. Each scratching finger consists of a sheaf of 10 steel wires held fast in a tightly coiled spring. The protruding wires do the scratching. The coils spring

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Experience has proved that the wall thickness of oil field pipe isn't always full-gauge. Inasmuch as the outside diameter is closely controlled at the mill, any internal deviations usually result in a loss of wall thickness. These "mill deviations" can of course exist in used as well as new pipe.

Internal corrosion can also damage pipe beyond the safe-point — an important factor if used pipe is to be re-run.

So before *any* pipe is placed in high-pressure service, an Otis "Surface" Caliper Survey is recommended in order that defective joints can be set aside.

Otis "Surface" Caliper Surveys can be made on location or in the pipe yard. The service is readily available, relatively inexpensive, requires a minimum amount of time, and it is the most accurate and thoroughly reliable method available for verifying the internal condition of new or used tubing.

How the Surveys Are Made—As a special calipering instrument is drawn through a joint, mechanical feelers contact the inside wall of the pipe. When a corrosion pit or reduction in wall thickness is encountered, outward movement of any one of the feelers causes an electrical signal to be transmitted to and logged by a strip-chart recorder. Thus the extent and location of any internal defect is mechanically detected and each joint can be immediately classified and color-coded accordingly. After the entire lot is surveyed, an experienced Otis corrosion engineer compiles a complete, detailed, permanent report on the internal condition of the pipe. Tubing can also be cleaned internally and/or drifted if desired.

Don't run the risk of installing defective joints in high-pressure service. Without obligation, your nearest Otis office will be glad to describe this new service to you in detail, show you sample surveys, and explain how the service may save you a costly salvage job later in the producing life of your wells.

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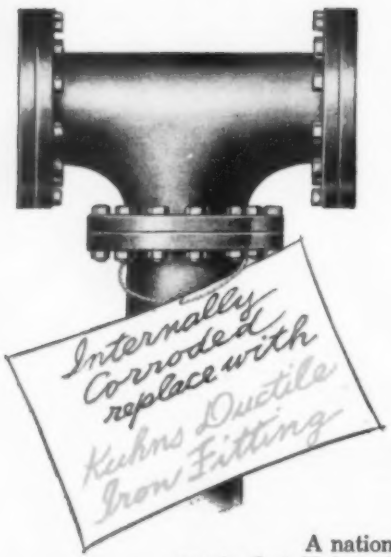
Run an Otis "Surface" Caliper Survey
Before you run your pipe - and be sure!



IF YOU'RE HANDLING CORROSIVE FLUIDS...

K

DUCTILE IRON FITTINGS ARE A MUST!

A nationally known chemical manufacturer reports that Kuhns ductile iron pipe fittings lasted six times longer in raw water lines than ordinary fittings. The brackish water at 80° C. contains 100-2000 parts chloride per million.

They also report excellent results with flanged ductile iron fittings on pumps operating up to 200° C. Other uses reported for Kuhns "DI" fittings include handling oleum at 40° C. to 100° C., steam at 125 psi, steam condensate, nitrogen at 175 psi, carbon dioxide at 150 psi, propane, ammonia, isobutylene, isobutane, and all weak acids.

SAFETY FACTOR

The smooth walls of Kuhns ductile iron fittings, their basic resistance to corrosion, high yield strength of 45,000 psi and excellent thermal shock resistance mean greater plant safety and lower maintenance costs wherever corrosion or volatile fluids are handled.

LISTED BY UNDERWRITERS' LABORATORIES, INC.

"K" Flanges and Flanged Fittings

Elbows, base elbows, 45° elbows, side outlet elbows, tees, side outlet tees, and reducers in straight and reducing sizes. Pressure rating, 500 psi by Underwriters' Laboratories, Inc. Flat faced flanges shipped as standard. Extra heavy flange dimensions and raised faces available on request. Look for the "DI 500" on each. Complete range of sizes through 12".

"K" Screwed Fittings*

Pressure ratings listed by Underwriters' Laboratories, Inc.

STEAM AND OIL AT 550° F.
¼" to 3" ..... 300 lbs.

LIQUID AND GAS AT 150° F.
¼" to 1" .....2000 lbs.
1¼" to 2" .....1500 lbs.
2½" to 3" .....1000 lbs.

*Ductile iron fittings are available in any size in Kuhns' complete cast iron line, ¼" through 12".

NOTE: These fittings are excellent for liquefied petroleum gas systems. Look for the "DI 300" on each.

From the melt in modern electric furnace through to critical inspection, these fittings are made in accordance with A.S.T.M. specifications A-339-55, A-395-55T to provide nodular structure and highest quality to meet industry's strictest requirements.

"K" fittings are available nationally through better wholesalers.

K **THE KUHNS BROTHERS CO.**

1800 McCall Street • Dayton, Ohio

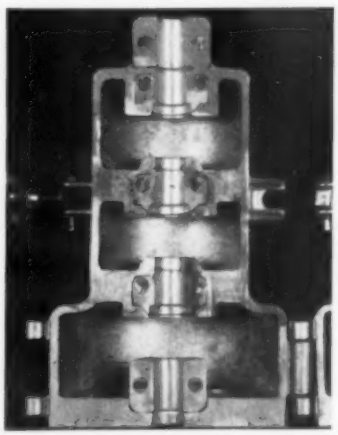
1887 — 71 Years of Continuous Progress — 1958

them back to their original position after each stroke.

The coiled springs prevent damage to the scratching fingers before and during insertion into the hole. A slight dogleg near the tips of the wires keeps them from disturbing the mud cake on the way down.

The scratchers come in sizes to fit API casing in sizes from 4½ to 13⅜ in. Every model features a strong, hinged, clamp-around design. **Write or call: Byron Jackson Tools, Inc., Subsidiary of Borg-Warner Corp., P. O. Box 2017A, Terminal Annex, Los Angeles 54, for details on scratchers.**

•



New Tool Cleans Drilling Line Fast

The tool is designed to clean any type of line by use of air and water injection or steam injection. Sand lines, logging-unit lines, and others can be cleaned at rates of 1,500 ft. per minute.

The tool is placed around the line and sets on the drill pipe for line runs on surveys. No tie down is needed. Air and water lines are connected to the nearest supply. For retrieving line, a small stream of water is turned on and air injected at 70 to 200 psi.

The hose connection is ⅜ in. i.d., 150 psi. The size of the pipe fittings is ¼-in. **Write or call: Jet Away Corp., Ventura, Calif., for details on line cleaner.**

•

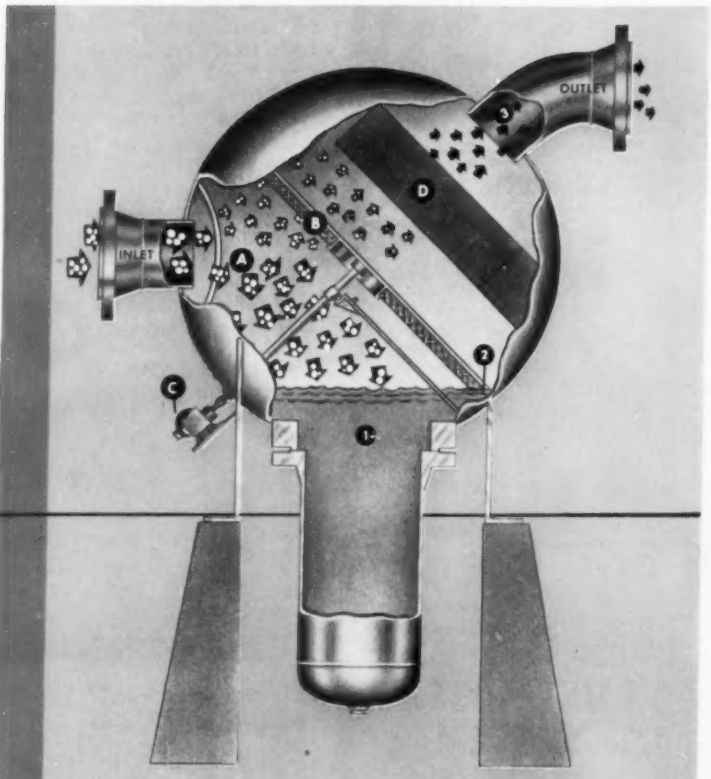
Petroleum Inhibitor Minimizes Deposits

The new UOP multipurpose dispersant inhibitor for petroleum products bears the trade name, Polyflo 100. The maker reports it proved exceptionally potent in minimizing deposits and stabilizing color in diesel

MORE EFFICIENT RESULTS!

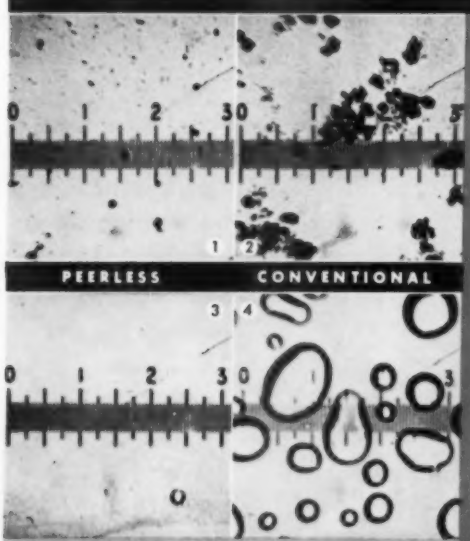
PEERLESS SCRUBOSPHERE*

*Spherical scrubber for dust and liquid removal from gas flow



LEGEND OF ABOVE CUTAWAY

The majority of incoming liquid (A) and solid particles are directed to either side and down into reservoir (1). Lighter solid particles carried by gas stream are separated on surfaces of contactor (B) which are kept wet and clean by revolving thru liquid reservoir (2). Contactor is revolved by explosion-proof gear motor (C). Mist Extractor (D) removes any remaining liquid particles from gas stream prior to outlet (3).



These photographs were made of microscope slides introduced downstream of the Scrubosphere and a conventional vertical oil bath cleaner under the same operating conditions. Plates 1 and 2 show the comparative amounts of iron oxide not removed with the amounts introduced being identical. Plates 3 and 4 indicate comparative oil loss with vapor rate through the vessels being the same.

LOOK AT THIS TEST The test at the left indicates the superiority of Peerless Scrubosphere over conventional oil bath dust scrubbers. The SCRUBOSPHERE operates with no loss of efficiency at low flows, minimum liquid loss, and very low pressure drop. Other outstanding features include easy vessel access with removable self cleaning contactor, a sump for slugs of solid or liquid particles, and minimum cost.

For detailed information write for Bulletin No. 181

PEERLESS MANUFACTURING CO.

P.O. Box 13165 Dallas, Texas

Representatives in All Principal Cities

PEERLESS MFG. CO. DALLAS TEXAS

"OVER 20,000 SEPARATORS and SCRUBBERS IN SERVICE"

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BUST RUST
with this sure ONE-TWO SYSTEM

1. PRIME with Rustmaster, proved by laboratory comparison tests to be the best rust inhibitor!

2. FINISH with one of General's specialized industrial coatings.

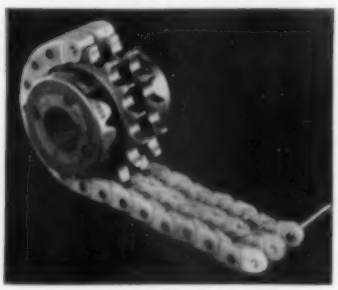
RUSTMASTER SYSTEM

Ask for details and specifications.
GENERAL PAINT CORP.
Tulsa and San Francisco

oils, distillate burner oils, and residual fuels. Depending upon the application, from 5 to 15 lb. of the additive is required to treat 1,000 bbl. of product.

Applied to refinery streams, the new additive prevents deposition and fouling in heat exchangers and reboilers. Crude oil and residual fuel-oil tanks and transfer equipment may be kept free of sediment and waxy deposits with it. **Write or call: Universal Oil Products Co., 30 Algonquin Road, Des Plaines, Ill., for details on dispersant inhibitor.**

●



Nylon Chain For Coupling Needs No Cover

The chain element of the new flexible coupling is constructed of nylon segments and stainless-steel pins. Without special tools, it can be disassembled or connected at any link. And it fits standard, stock-steel, roller-chain sprockets.

The coupling handles loads from fractional to 40 hp. and speeds from 500 to 5,000 r.p.m. The complete coupling with ½-in. pitch links and soft-steel sprocket or chain elements are available. **Write or call: Morse Chain Co., Ithaca, N. Y., for details on nylon coupling.**

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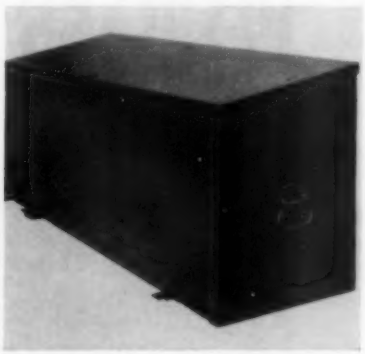


Chest Permits On-The-Job Tool Storage

A slot allows storage of handled tools in this tool chest made of all-welded, 18-gage steel. It provides a means for storage of tools, equipment, change of clothing, and extra stock for job-site workmen. Called Elmers tool chest, it's available in two sizes. It weighs enough to discourage easy removal.

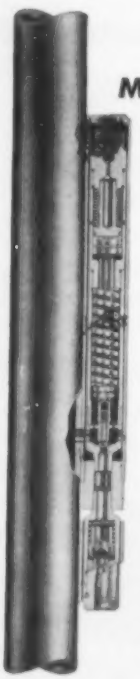
An extended, flanged, sloping top provides weather protection. The steel slot for handled tools permits storage of six tools. They cannot be removed when the top is locked. **Write or call: Scott-Rice Co., 610 South Main Street, Tulsa, for details on all-metal tool chest.**

●

TRADE MARK
TIME TESTED
MACCO
GAS LIFT
REG. U.S. PAT. OFF.

MACCO "SPRING" FLUID OPERATED VALVE

("No Charge" Bellows)



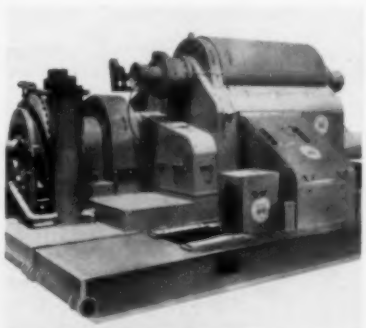
CM2-FS

In this type valve, with no bellows charge, the spring tension is set as the valve opening pressure. The bellows functions only as a diaphragm, and the spring functions as the total actuating force. When once a valve opening pressure is set by spring tension, the pressure remains unchanged regardless of hydrostatic pressure or temperature applied to the valve in the well. Since the spring in this valve is the total actuating force, the valve may be set with either extremely low or high opening pressure (100-3000 psi). On the "SPRING" fluid operated valve, the spring tension keeps the valve closed until a desired predetermined head of fluid has entered the tubing.

Macco "Spring" Fluid Operated Valves are manufactured in two sizes. The CM2-FS Valve is 1½" diameter for all normal installations. The CM-1FS Valve is 1" diameter and has wide application in dual, macaroni, and slim-hole lifting.

For further information regarding lifting with Macco Fluid Operated Valves, write for Brochure No. 3-12.

MACCO OIL TOOL COMPANY, INC.
1521 Prince P. O. Box 7288 Houston 8, Texas
Phone UN 1-1253



Electric Rig Rated At 1,300 hp. Input

The Type 1320-DE electric drilling rig for the 13,000 to 20,000-ft. depth range is designed primarily for d.c.

New Equipment

power. It uses 1¼ or 1⅜-in. wire line. The draw works is basically a one-piece design with an 18-in. beam base which provides for a sand reel.

The rear section supports the electric motors and motor-drive portion of the draw-works transmission. It is detachable for shipping. A small front section, also detachable, supports the rotary-drive countershaft. The rotary machine may be independently driven by a separate electric motor.

Power for the draw works is generally one 1,250-hp. or two 625/650-hp. d.c. motors mounted on a separate skid. A two-speed drive, through 1½-in. pitch, sextuple chains, is utilized between motor-drive shaft and draw-works jackshaft. **Write or call: National Supply Co., Two Gateway Center, Pittsburgh, for details on electric drilling rig.**

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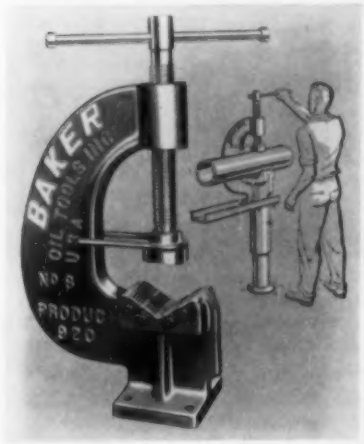

Open-Side Vise Holds Valves or Pipe

This screw-type, open-side vise not only holds tubing, casing, and drill pipe but also such odd-shaped pieces as valves and manifolds in sizes of 2⅜ to 8⅝ in. It is fast to use, too. Objects may be placed in it from any one of three sides. The fourth side acts as a steadying and positioning guide.

For added leverage, the counterbalanced handle can be swung into position and quickly extended.

One vise takes the place of the usual combination of vises required to cover a comparable range. It saves time and eliminates wasted steps by concentrating operations at a single location. **Write or call: Baker Oil Tools, Inc., Box 2274 Terminal Annex, Los Angeles 54, for details on open-side vise.**

BEST PUMP FOR ABRASIVE FLUIDS

3 H-F TUBE ROD PUMP

The design principle of three concentric, free-fitting tubes which use the well fluid to effect the plunger seal makes this special insert pump especially efficient in wells with excessive float sand, dirty fluid, or high bottom hole temperatures that would cause conventional pumps to stick.

The plunger is free-falling, which allows a greater strokes-per-minute rate without being hard on the rods. To compensate for the loose plunger fit, part of the production fluid is directed into the annular space between the barrel tube and the outer traveling tube and used as the sealing medium. H-F 3-Tube pumps are fitted to A.P.I. specifications, including standard balls and seats. Either regular or on-and-off types are available in 2" x 1¼", 2½" x 1¾" and 4" x 3¼" sizes to 25' lengths.

For hard-to-pump wells — or as a good, all-around pump for average wells — you can depend upon this pump to make good production without frequent pulling jobs. Ask your supply store, or write to us for descriptive bulletin. Harbison-Fischer Mfg. Co., P. O. Box 127, Fort Worth.

HARBISON · FISCHER MFG. CO. FORT WORTH

"Best Pumps in the Oil Patch" ®

WHY SAVE PENNIES HERE

AND LOSE DOLLARS HERE

When a possible saving based on the use of a "cheap" inhibitor is suggested, be sure you appraise the possible "savings" practicably. In the first place, you aren't buying corrosion inhibitors,—you're buying *protection against corrosion damage.* The maximum potential savings which might accrue from the few dollars saved by the purchase of a "cut-rate" inhibitor will never compensate for the over-all cost of a pulling job.

The economy of corrosion control is based on just one factor, continuous, trouble-free production operations. The few dollars more or less spent for proved protection are, in fact, negligible when compared to the total cost of lifting the oil.

Whatever you do, be sure you get all the facts. The Kontol field engineer in your area will be glad to arrange for suitable comparative tests, without cost or obligation. You can then base your inhibitor selection on facts and figures.

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DIVISIONS OF PETROLITE CORPORATION

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Chemicals and Services for the Petroleum Industry

Demulsification • Desalting • Corrosion Inhibiting
Paraffin Removal • Scale Prevention • Water De-oiling
Injectivity Stimulation

KF-59-2

Giant Hoist Lifts 45 Tons To A Height Of 103 Ft.

The frame of the hoist is 8¼ ft. wide and 9½ ft. long. On the drum, 922 ft. of cable is wound in double-reeved fashion. Drum diameter is 4 ft. Drum length is 6½ ft.

The hoist has the ability to raise and lower a full-capacity load with a precision of 0.008 in. Twin-brake control is used. One brake is regenerative electric. The hoist motor also serves as a generator and automatically slows itself when weight of the load tends to overspeed the lowering action. The other half of the braking action is from electromechanical brakes which stop the precontrolled loads instantly. **Write or call: R. G. LeTourneau, Inc., 2399 South MacArthur, Longview, Tex., for details on hoist.**

●

Surge-Protection System for Pipelines

The system is an all-relay, self-checking type to automatically protect pipelines and pumping stations from dangerous line surges. Under normal operation, the system continuously transmits, by carrier or direct current, a 120 pulse per minute code from the monitoring location to one or more upstream pumping stations.

Also operating continuously at the monitoring station, but having no effect on the transmitter, is a 180 pulse per minute code.

Upon receipt of the 180 code at the upstream station or stations, breaker-trip coils automatically initiate shutdown of the upstream pump station. Audible and visual fault alarms operate too. **Write or call: Union Switch & Signal, Div. of Westinghouse Air Brake Co., Swissvale, Pa., for details on pipeline-surge protection system.**

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METHOD OF PIPING

VICTAULIC HAS EVERYTHING...

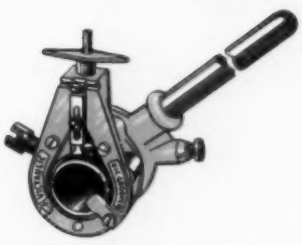
VICTAULIC COUPLINGS
Simple, fast, reliable. *Styles 77, 77-D,* for standard uses with steel or spiral pipe, — *Style 75* for light duty. Other styles for cast iron, plastic and other pipes. Sizes ¾" to 60".

ROUST-A-BOUT COUPLINGS
For plain or beveled end pipe *Style 99.* Simple, quick, and strong. Best engineered and most useful plain end coupling made — takes a real "bull-dog" grip on the pipe. Sizes 2" to 12".

VICTAULIC SNAP-JOINTS
The new, boltless, speed coupling, *Style 78.* Hinged into one assembly for fast piping hook-up or disassembly. Hand locks for savings in time and money. Ideal for portable lines. Sizes 1" to 8".

COUPLINGS FOR EVERY PIPING JOB

VICTAULIC FULL-FLOW FITTINGS
Elbows, Tees, Reducers, Laterals, a *complete line*—fit all Victaulic Couplings. Easily installed — top efficiency. Sizes ¾" to 12".



VIC-GROOVER TOOLS
Time saving, on-the-job grooving tools. Light weight, easy to handle — operate manually or from any power drive. Sizes ¾" to 8".

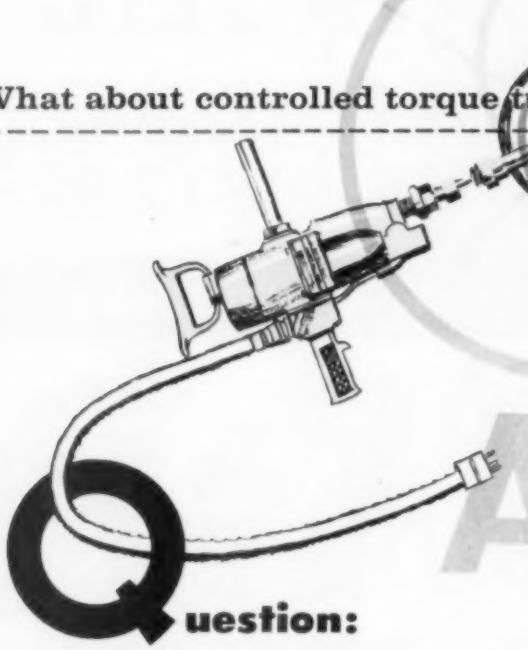
PLUS FITTINGS AND GROOVING TOOLS

"EASIEST WAY TO MAKE ENDS MEET"

Promptly available from distributor stocks coast to coast.
Write for NEW Victaulic Catalog-Manual No. E-4.

VICTAULIC COMPANY OF AMERICA
P. O. BOX 509 • Elizabeth, N. J.

What about controlled torque tube rolling in heat exchangers?



Question:

Is controlled torque tube rolling *imperative* to high quality heat exchanger fabrication?

Answer:

Absolutely, if uniformity is expected in the expansion of the tube within the tube-sheet. The highly specialized electronic equipment used assures a fluid-tight joint, and protects . . .

. . . Western customers against human error. With the application of the controlled torque principle, the entire tube rolling operation becomes a matter of mechanical precision and machine perfection. As a result, Western heat exchangers are structurally sounder, are less susceptible to corrosion and can be retubed more easily. Controlled torque tube rolling at Western eliminates the dangers of over-rolling and work-hardening, which so often cause structural weakness, invite corrosion, and increase maintenance costs.

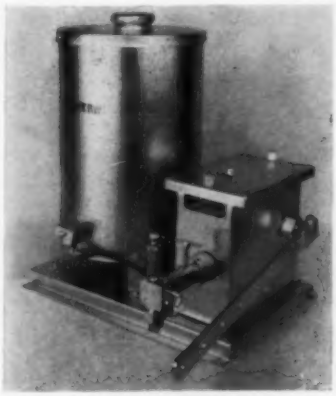
WESTERN

HEAT EXCHANGERS

WESTERN SUPPLY COMPANY

P.O. Box 1888 – Tulsa, Oklahoma

Constant attention to the potentials and restrictions of a wide range of metals is reflected in Western's application of controlled torque tube rolling for *all* customers.



Chemical Pump Primes By Opening Gear Box

The open position on the cam enables an operator to prime or test the feeder by opening the gear box, turning the cam into position, and pumping the piston until flow begins. According to the maker, there's no waiting for prime to show and nothing to disconnect.

Another feature is a fast injection stroke. The suction stroke is 50% slower to assure a full charge, even in cold weather. Accuracy in a wide range of volumes is possible through a variable piston stroke and five separate feed settings on the pump lever.

To prevent corrosion and wear, the beam-operated chemical pump has a dustproof gear case; stainless-steel valve balls, piston, and cages, and a double-bearing ratchet shaft. Maintenance is simplified through a disposable discharge-ball seat. **Write or call: Beal Equipment Co., 420 East Second, Odessa, Tex., for details on new chemical pump.**

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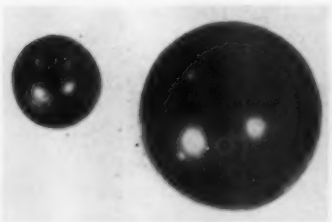


Rubber Sphere Eases Product Separation

The new Maloney pipeline sphere is a liquid-filled, rubber type designed to operate in all products lines where an intermediate seal to transmit pressure is desired. It's especially designed for product separation and calibration of meter loops in products lines. The sphere has also been found useful for water and product removal. The sphere will withstand runs of 500

WE SELL BURNER *Engineering*

John Zink engineering is the answer to your burner problems. In thousands of installations John Zink gas, oil and combination burners have proved their merits by years of satisfactory service.

John Zink engineering has been the answer to countless special problems, such as:

- Famous JZ Smokeless Field Flares . . . in use wherever smoke or smog is a problem.
- JZ Sludge Burners . . . an answer to waste disposal for chemical plants.
- JZ Inert Gas Generators . . . for increased safety in process plant operations.
- JZ Ultra-High Temperature Air Heaters . . . for research programs.

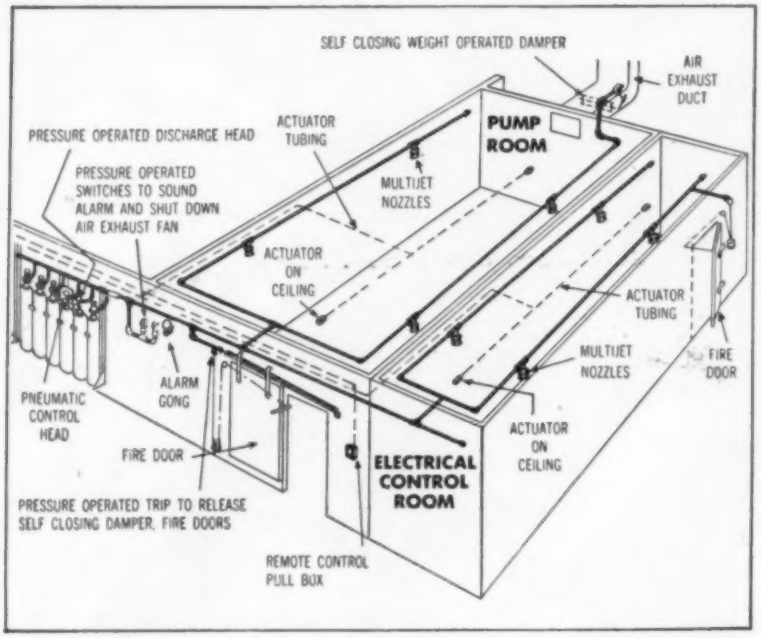
WE MAKE HEAT . . . AROUND THE WORLD

Throughout the world John Zink engineering is working for the petrochemical industry. Why not put it to work for you? Inquiries on burners for special application are always welcome . . . and the John Zink research furnace provides excellent testing facilities for new designs.

For information on the full line of John Zink burners, write for catalog REF-57.

JOHN ZINK COMPANY
4401 SOUTH PEORIA TULSA 5, OKLAHOMA

STOP PUMP ROOM FIRES THE INSTANT THEY START!



Most dependable fire protection on the market today, a built-in Kidde Fully Automatic Carbon Dioxide Fire Extinguishing System gives you 24-hour-a-day protection, guards even the most dangerous of fire hazards.

Pressure-operated for the utmost in dependability, Kidde systems use no falling weights, no clumsy mechanical triggering methods. Special rate-of-temperature-rise detectors trigger the system at the first sign of fire, pneumatic control heads insure instantaneous and complete carbon dioxide discharge. Automatic electric actuators also are available. In a Kidde system, all moving parts are self-enclosed for safety, and visual indicators show at a glance whether the system is "set" or "released."

To help you solve your fire protection problems, Kidde has prepared an informative booklet which fully explains Kidde Automatic Fire Extinguishing Systems, how they work, and how they can save you money in your business. For your copy, fill out the coupon below or write to Kidde today.

WALTER KIDDE & COMPANY, INC.
454 MAIN STREET, BELLEVILLE 9, N. J.

*Please send me your Engineered Fire Equipment Booklet, I-19 and complete information on Kidde systems. I am interested in protecting the following hazards:*_____

NAME _____

ADDRESS _____

CITY _____ STATE _____

miles or more before wear becomes excessive, the maker reports. It will follow flow through sharp-radius bends and tees.

The sphere requires no maintenance or assembly other than proper sizing of the actual operating diameter. Nominal pipe sizes presently available are 4, 6, 8, 10, 12, 14, 16, and 20 in. **Write or call: F. H. Maloney Co., 2301 Texas Avenue, P. O. Box 1777, Houston, for details on pipeline spheres.**

●

Electric Oil-Sample Heater Is Explosionproof

The Model C-8-115-T electric oil-sample heater makes an efficient means of electrically heating oil samples in laboratories, pumping stations, loading racks, and similar places, the maker reports. It can be connected to any 115-volt a.c. line by tying in lead wires.

Explosionproof and thermostatically controlled, it can heat up to eight samples at one time. Permanent-type thermometers may be installed. The heater is furnished with a cover. **Write or call: L-K Pump Valve Co., P. O. Box 901, Houston 1, for details on Model C-8-115-T electric oil-sample heater.**

●

Pipe Available in X-42, X-46, and X-52 Grades

In small-diameter pipelines, designers can take advantage of the features offered by high-strength line pipe by using this new pipe. It comes in a 6⅝-in. size in weights below 12.89 lb. and in 1 through 4½-in. sizes to meet API line-pipe specifications 5L-X in grades X-42, X-46, and X-52.

The pipe makes it possible to design high-strength lines in the smaller sizes. Price savings as high as 40% combined with lower horsepower requirements and greater throughput can be utilized, the maker reports. **Write or call: Tex-Tube, Inc., 1503 North Post Oak Road, Houston, for details on small-size line pipe.**

Prove to Yourself

TEXASTEEL SUCKER RODS and LIBERTY PUMPING UNITS

There is no finer oil well pumping equipment made than TEXASTEEL SUCKER RODS and LIBERTY PUMPING UNITS. LIBERTY equipment has been proven in field operation since 1918. But the only way *you* can know the performance of this equipment is to *prove it to yourself.*

TEXASTEEL SUCKER RODS and LIBERTY PUMPING UNITS are available from twenty strategically located field warehouse stocks* to insure prompt delivery to your well site. They are sold through supply stores only.

Descriptive technical literature and price sheets are available on all LIBERTY products. Please contact your LIBERTY Sales Representative or local supply store.

*ARKANSAS: Magnolia. COLORADO: Sterling. KANSAS: Great Bend. LOUISIANA: Shreveport. MISSISSIPPI: Laurel, Natchez. NEBRASKA: Kimball. NEW MEXICO: Farmington. OKLAHOMA: Duncan, Oklahoma City. TEXAS: Abilene, Alice, Albany, Borger, Wichita Falls, Kilgore, Houston, Pampa, Odessa. WYOMING: Casper

TEXASTEEL SUCKER RODS and LIBERTY PUMPING UNITS

Excellent products of Liberty Craftsmanship and Engineering

ENGINEERED EXCELLENCE

LIBERTY

MANUFACTURING COMPANY

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LM-2

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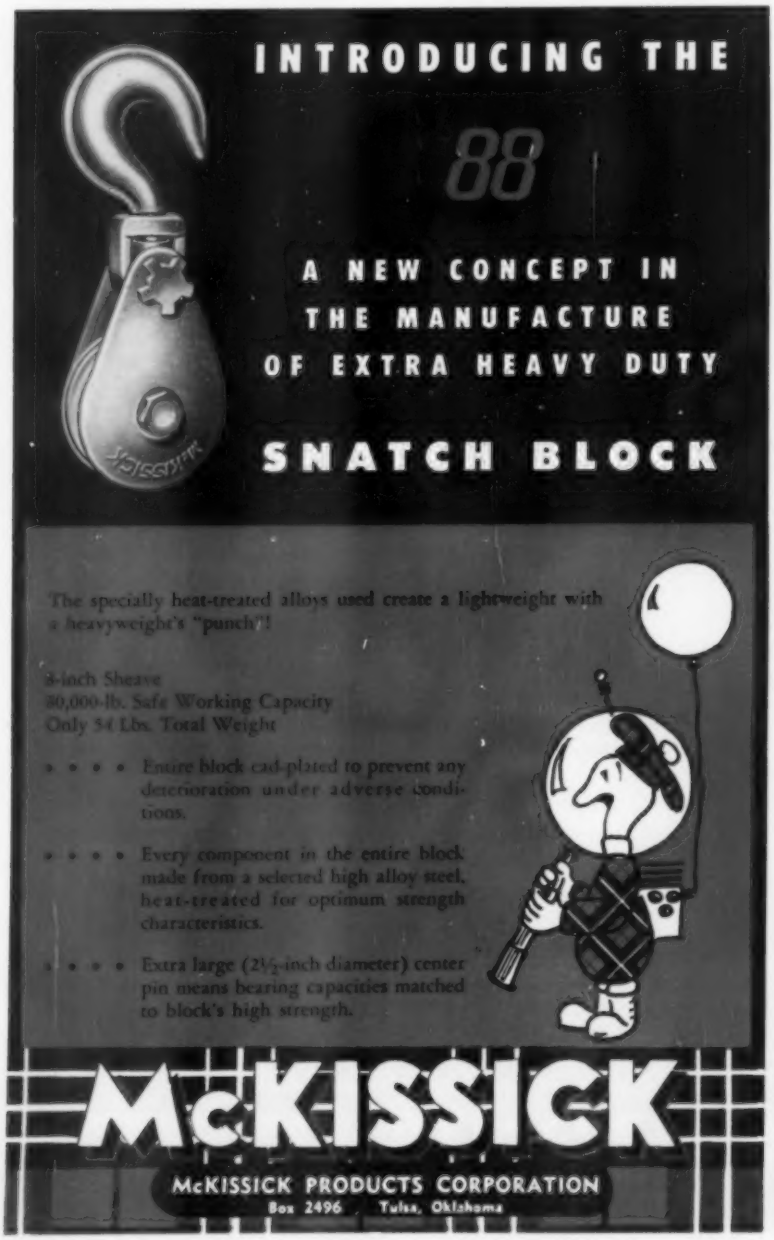
New Literature

Electrode selection . . .

is the subject of a new 12-page welding directory. To help select the best electrode for overhead, downhand, sheet metal, or other work, the directory describes basic characteristics of each family of electrodes. This includes deposition, arc action, amount of slag, bead appearance, and general applications. The directory then differentiates between individual electrodes within the family and gives physical properties, current ranges, sizes, and welding procedures for each electrode. **Write or call: Lincoln Electric Co., 22801 St. Clair Avenue, Cleveland 17, for welding directory.**

Semirigid and rigid plastic . . .

pipe is described in a new four-page folder. The bulletin discusses a variety of uses for three types of the plastic pipe. The types featured are Kralastic, Butyrate, and PVC. The company also makes polyethylene flexible-coil pipe, drainage pipe, well casings, and conduit. **Write or call: Southwestern Plastic Pipe Co., Box 117, Mineral Wells, Tex., for plastic-pipe folder.**


INTRODUCING THE
88
A NEW CONCEPT IN
THE MANUFACTURE
OF EXTRA HEAVY DUTY
SNATCH BLOCK
The specially heat-treated alloys used create a lightweight with a heavyweight's "punch"!
8-inch Sheave
30,000-lb. Safe Working Capacity
Only 54 Lbs. Total Weight
• • • • Entire block cad-plated to prevent any deterioration under adverse conditions.
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• • • • Extra large (2½-inch diameter) center pin means bearing capacities matched to block's high strength.
McKISSICK
McKISSICK PRODUCTS CORPORATION
Box 2496 Tulsa, Oklahoma

Flange-dimension reference .

booklet is a 15-page bulletin now available. It is based on tentative API Standard 6B, Fifth edition. **Write or call: Oil Center Tool Co., P. O. Box 3091, Houston, for flange dimension reference booklet.**

Diesel, gas, and dual-fuel . . .

engines with applications in pipelining are reviewed in new four-page Bulletin 116. The catalog lists 19 models of six basic engines to meet a variety of pipeline power requirements. All are of four-cycle, vertical, in-line design. They're available with six or eight cylinders and either naturally aspirated or supercharged, for slow or medium speed. **Write or call: White Diesel Engine Div., White Motor Co., 1401 Sheridan Avenue, Springfield, Ohio, for Catalog 116.**

Use of cyclones . . .

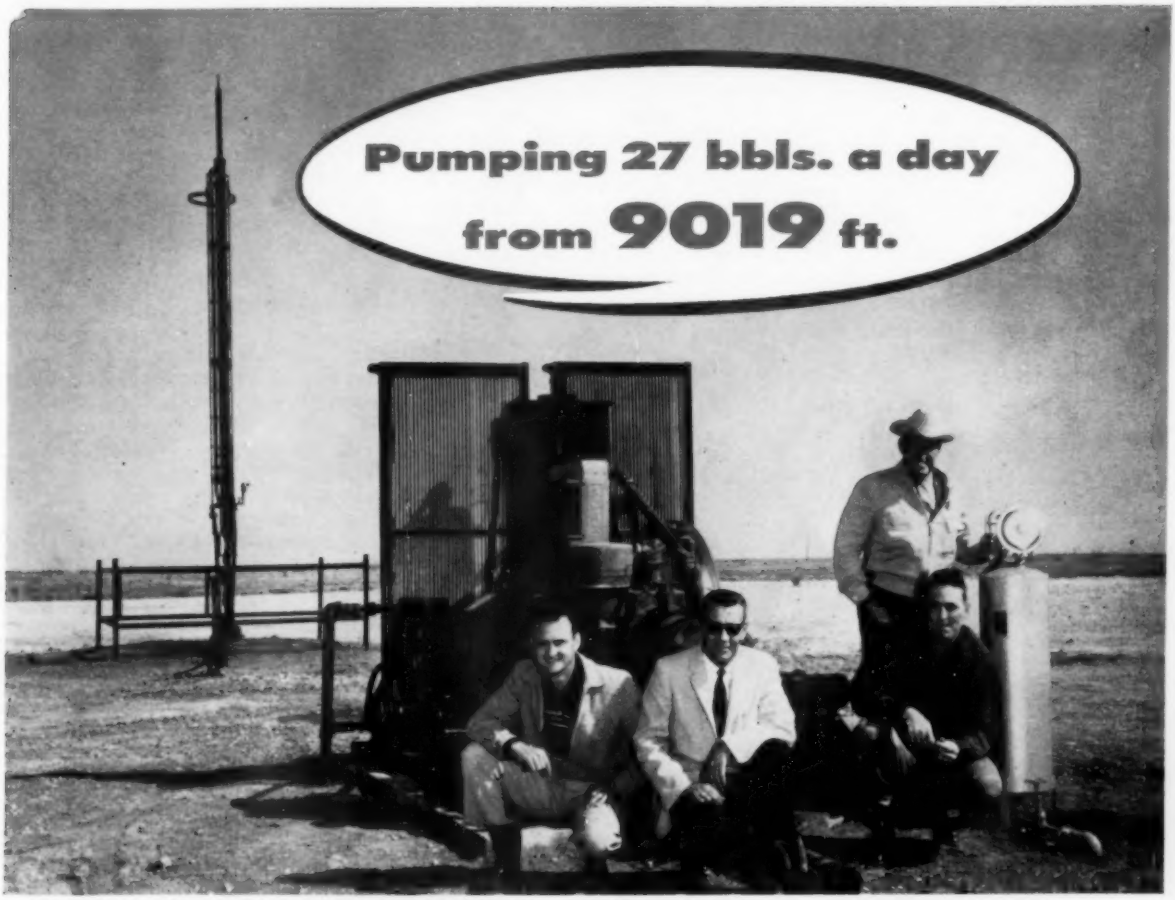
as a tool to lower the costs of drilling operations is discussed in new Bulletin 1157. The 16-page booklet contains data and illustrations of the cyclones used by drilling operators. Charts and graphs give detailed information. **Write or call: Heyl & Patterson, Inc., 55 Fort Pitt Boulevard, Pittsburgh 22, for Bulletin 1157.**

Photogrammetry . . .

a short, economical route to engineering design is discussed in a new eight-page booklet. It reports on the application of aerial surveys to engineering problems. Typical examples include photo analysis and reconnaissance mapping for highways, contour plans for highway design, and earth quantity estimates. Other services covered are maps for town planning, microwave-relay towers, and other studies. **Write or call: Canadian Aero Services, Ltd., 348 Queen Street, Ottawa 4, Canada, for photogrammetry bulletin.**

Nuclear magnetic . . .

resonance that supplies fast answers about product composition is discussed in a 12-page reprint. The technical article covers basic NMR theory, operation of a typical NMR apparatus, research applications of NMR analysis, and use of the analysis in industry. Simple measurement, analysis, and open or closed-loop process control are discussed. Control of a continuous-circulation drier is one of the examples cited. **Write or call: Schlumberger Well Surveying Corp., Ridge-**



WITH A JOHNSTON *Hydraulic* PUMPING UNIT

—"The most economical Pumping Unit ever built."

The photograph above was made in the West Texas area. This well proves that low production deep wells can be produced profitably with a Johnston Hydraulic Pumping Unit.

Yes — Johnston Hydraulic Pumping Units are the answer for your wells going on artificial lift. They are cheaper in every respect!

—INITIAL UNIT COST
—INSTALLATION COST
—TRANSPORTATION COST
—LESS COST ON DOWN-HOLE EQUIPMENT
—MORE SALVAGE

There is a Johnston Hydraulic Pumping Unit for every depth, from "grass roots." Contact your Supply Store or write for special pamphlet.

2 ft. stroke . . . 3 ft. stroke . . . 6 ft. stroke . . . 9 ft. stroke . . . 12 ft. stroke

Distributed Through Selected Supply Stores

ENGINEERED OIL TOOLS, Inc.

1710 Burnett St. **Houston, Texas**

field, Conn., for Nuclear Magnetic Resonance reprint.

Pumping units . . .

are described in a new eight-page brochure. The bulletin describes the advantages of hydraulic pumping units. Detailed charts illustrate flow and construction characteristics of the units. Production tables and specifications for each are included, as well as photographs and specifications for optional components. **Write or call: Axelson Mfg. Co., 6160 South Boyle Avenue, Los Angeles 58, for Pumping Unit bulletin.**

All-electric deck crane . . .

is described in a new four-page folder. The crane features positive load control for capacities up to 25 tons, and has several safety features. Recommended uses of the crane are aboard marine craft, docks, or other locations where constant lifting is required within a prescribed area. **Write or call: R. G. LeTourneau, Inc., 2399 South MacArthur, Longview, Tex., for all-electric deck-crane bulletin.**

Piping system . . .

design, manufacture, testing, or installation is discussed in new 48-page Bulletin FB-77. Tables in the bulletin show a simple mathematical procedure to determine requirements for: (1) minimum wall or maximum pressure, (2) minimum pressure-stress ratios, (3) maximum allowable working pressure, (4) maximum allowable stress, and (5) nominal wall thickness. **Write or call: Babcock & Wilcox Co., Tubular Products Div., Beaver Falls, Pa., for Bulletin FB-77.**

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Need silencers on short notice? Contact Maxim. We are now stocking an increasing number of the more widely used types and sizes. As a result, we may be able to give you immediate delivery.

If the type and size you need is not in stock, you can still depend upon Maxim to give you best delivery — from the *most complete line of industrial silencers.* Equally important, you can count upon outstanding performance — in the tradition that has made Maxim the preferred silencer throughout industry. Maxim, more than ever, stands for special customer service.

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98 HOMESTEAD AVENUE • HARTFORD, CONN.

Radial loads . . .

what causes them, how to measure them, and how their effects on process pumps are controlled are discussed in eight-page Bulletin EM-79. The booklet describes the cause, effect, and cure of damaging radial thrust forces on process-pump impellers, wear rings, seals, stuffing boxes, and the shaft itself. **Write or call: Peerless Pump Div., Food Machinery & Chemical Corp., 301 West Avenue 26, Los Angeles 31, for Bulletin EM-79.**

Access fittings . . .

for oil wells, pipelines, refineries, and other industry are described in new 32-page Catalog C-58. The access fittings is a device for gaining access under pressure to interiors of oil wells, pipelines, and other pressure vessels. The plastic-bound booklet describes the access fitting principle, fittings and plugs, and applications for oilfield production, wellheads, corrosion surveys, and fracturing and drilling. **Write or call: Cosasco Div., Perfect Circle Corp., 11655 McBean Drive, El Monte, Calif., for Catalog C-58.**

Wax solvents . . .

are reviewed in a new four-page Data Sheet S-100. A wax-identification table shows the physical characteristics of the wax, the type, and the suggested treatment. Principal uses and applications of the line of solvents and dispersants are given. The cause of wax formations in crudes is also discussed. **Write or call: W. D. Johnson Chemical Laboratories, Inc., P. O. Box 7004, Long Beach 7, Calif., for technical data sheet S-100.**

Product recovery . . .

in the natural-gasoline plant is discussed in a new Application Data Sheet GC-4203. The illustrated data sheet gives detailed information on the use of gas chromatography for continuous analysis of all important gas streams within the natural-gasoline plant for optimum output. **Write or call: Beckman Instruments, Inc., Process Instruments Div., Fullerton, Calif., for Application Data Sheet GC-4203.**

AUTOMATE NOW

with ASCOP

SUPERVISORY CONTROL and PULSE WIDTH TELEMETERING!

Supervisory Control by ASCOP is the modern low-cost way to automate remote transmission and distribution operations . . . both for the present and the future. ASCOP Supervisory Control is designed to grow with your requirements for additional reliable control of any number of remote points.

This advanced ASCOP system is the direct result of 11 years of first-hand experience. First came a decade of developing and producing pulse width data systems and components for exacting military applications. Then ASCOP worked closely with a leading public utility in perfecting an industrial remote-control system. Now ASCOP offers Supervisory Control with these important advantages:

Lowest Cost Channel — Maximum of 105 supervisory commands handled over any single channel capable of passing 15 pulses per second.

Extra Code Checks — All transmissions are given automatic triple code checks at both master and remote stations. This insures integrity of transmissions and eliminates chance of wrong operation or lost data.

Fast Response — Less than two seconds elapse between start of a control command at the master station and performance of the command at any remote station. New status of equipment is displayed at master station in one second.

Dependable Relays — All signals are encoded and decoded by long-life, field-proved, telephone-type relays with bifurcated precious metal contacts. Relays are housed in dust-proof cases.

Economic Flexibility — Future expansion of the system can be accomplished in the field simply and inexpensively by addition of relays and cases to original basic units. No costly changes in basic system are necessary.

Maximum Safety — "All Scan" and "Lamp Test" features enable operator of master station to run complete automatic checks for insuring maximum reliability of all control functions.

Telemetering — ASCOP pulse width telemetering is available with ASCOP Supervisory Control. Lowest cost single 15 pulse channel is used to telemeter up to 30 points continuously, time shared with the ASCOP control system.

For further information write for bulletin No. 971-101

See It At The Show! Drop in at Booth 81 and 82 during the Petroleum Industry Electrical Ass'n. Conference April 29-May 1, Hotel Adolphus, Dallas, Tex., and see new ASCOP Supervisory Control Equipment demonstrated by company specialists.

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EQUIPMENT MEN ..... IN THE NEWS

Continental-Emsco Co. Appoints Eight . .

according to a recent announcement. D. G. Sanders, San Angelo, Tex.; Harold L. Johnson, Fort St. John, B. C.; E. B. Brewer, Jr., Laurel, Miss.; James W. Dees, Morgan City, La.; and James D. Hunter, Venice, La.; were named store managers.

Other appointments include B. E. Wright, district production machinery specialist, Abilene, Tex.; and LaVern E. ReWerts, Sterling, Colo., and T. S. Coffee, Andrews, Tex., both D+B specialists.

Chiksan Co. Appoints C. J. Holcomb, H. W. Werhan . .

senior field engineer and field engineer, respectively. The announcement came from L. J. Smith, vice president and sales manager. Both have been assigned to the firm's Newark, N. J. branch office and will work under J. F. Powers, Jr., eastern regional sales manager.

Holcomb transferred to Chiksan from its Well Equipment Manufacturing Corp. division, with whom he was associated for 9 years, the last 6 as industrial sales representative for Chiksan and Weco products in the Gulf Coast area. He will serve Chiksan customers in petroleum, petrochemical, and chemical industries and will be primarily concerned with Chiksan's marine tanker loading equipment.

Werhan was formerly with the service department of Curtiss-Wright Corp.'s Wright Aeronautical Division and will serve guided missile and aircraft industries.

National Tank Co. Holds Management Conference . . .

as Jay P. Walker, president, discusses 1958 plans with the company's key management men. Operation procedures and policies were reviewed and plans formulated for 1958 operations.

Standing are: S. S. Parker, C. G. Wells, Walker, C. O. Glasgow, Merle Bryan, A. W. Francis, Jr., and Jack Shinkle. At the tables are: Ward Guinn, Jack Godwin, L. S. Allen, R. W. Coggins, Ed deYoung, Don Boling, Kenneth Shank, W. A. Todd, Lloyd Taylor, C. A. Lavery, Judd Lowd, King Stockton, Johnny Shelton, Joe Wells, Lloyd Conley, G. C. Wilde, Jack Williams, Jim Neish, Jim Brown, John Haws, Merton Whitlow, Russell Monis, I. E. Gandee, Walt Standridge, Riley Davis, Bill Becker, C. O. Meyers, Don Hampton, Jack Gibb, John P. Thomas, Jr., Sam Mays, Jay Stafford, Roger LaPlante, Don Unwin, Bob Robson, Lynn Burrus, Bill Willis, Rex Williams, Tracy Smith, Arthur Wade, Don Turner, J. D. Lowrie, Les Lamb, Herb Walker, Bill Dunn, Wayne Snow, and Dale Williams.

J. W. Breeden Appointed Manager of Sales . .

of the Dallas district, United States Steel Corp.'s American Steel & Wire Division, according to C. T. Gilchrist, western area manager of sales. He succeeds B. M. Ashbaucher who has been named district sales manager at Chicago.

J. W. BREEDEN

Breeden was with various drilling contractors in West Texas and New Mexico. He was formerly wire rope salesman at Odessa, Tex., for the division.

Welex, Inc., Held 2-Week Course In Houston . .

on interpretation and analysis of resistivity and radioactivity logging at its research and development laboratory. The course was conducted by R. B. Smith and was offered to 13 men of the sales department. Purpose of the class was to provide the salesmen all necessary information concerning techniques and systems of logging.

Those who completed the course are: R. J. Snook, engineer, Pratt, Kans.; J. F. Wells, engineer, Hobbs, N. M.; J. E. Haynes, district manager, Liberal, Kans.; W. P. Weatherby, sales engineer, Lafayette, La.; G. W. Aker, sales engineer, Wichita Falls, Tex.; P. E. Ganus, district manager, Grand Junction, Colo.; Jerry Rushmore, sales engineer, Monahans, Tex.; J. T. Thompson, sales engineer, Harvey, La.; Ken Harlow, logging trainee, Winfield, Kans.; C. C. Seamon, sales engineer, Farmington, N. M.; Jack Baker, sales engineer, Lake Charles, La.; E. B. Schulz, district manager, Snyder, Tex.; and H. T. Harvey, eastern division manager, Regina, Alta., Welex of Canada, Ltd.

Cleaver-Brooks Broadens Sales Organization . .

of the general sales division by the formation of five sales districts, J. C. Cleaver, president has announced.

The formation of sales division provides greater concentration of sales control within five major geographical areas through district sales managers located in New York City, Atlanta, Ga., Dallas, Tex., San Francisco, and Milwaukee, Wisc.

R. W. Watson, former sales manager of Sellers Corp. in Chicago, will manage the Milwaukee district; Frank R. Goulding, formerly of Penn Con-

Why Blowouts Are Getting Few And Far Between

Pipe bent like spaghetti . . . rigs reduced to scrap . . . and a fortune up in smoke is still clear in the minds of many oil operators.

In the middle 1930's, spectacular blowouts and costly fires were almost commonplace. Practically every new field, where deeper exploration was in progress, was pock-marked with a crater or two, grim reminders for the rigs that followed of the hazards that lay ahead for them.

The recognized discovery of "drilling mud" came with Spindletop where cows were driven through the earthen tanks to mix mud. Surface controls, such as blowout preventers, gained prominence after the famous "Wild Mary" Sudik in Oklahoma City.

Steady improvements in controlled drilling fluids and surface control equipment signalled the start of a new era in deeper drilling and completion practices. Throughout all the development stages of better well control, oil operators and PESA Members have worked as a team.

Still, there is much to be done.

And much of it will be accomplished in the future, as in the past, through the research facilities, time, money and personnel of members of the Petroleum Equipment Suppliers' Association.

PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION

* PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION

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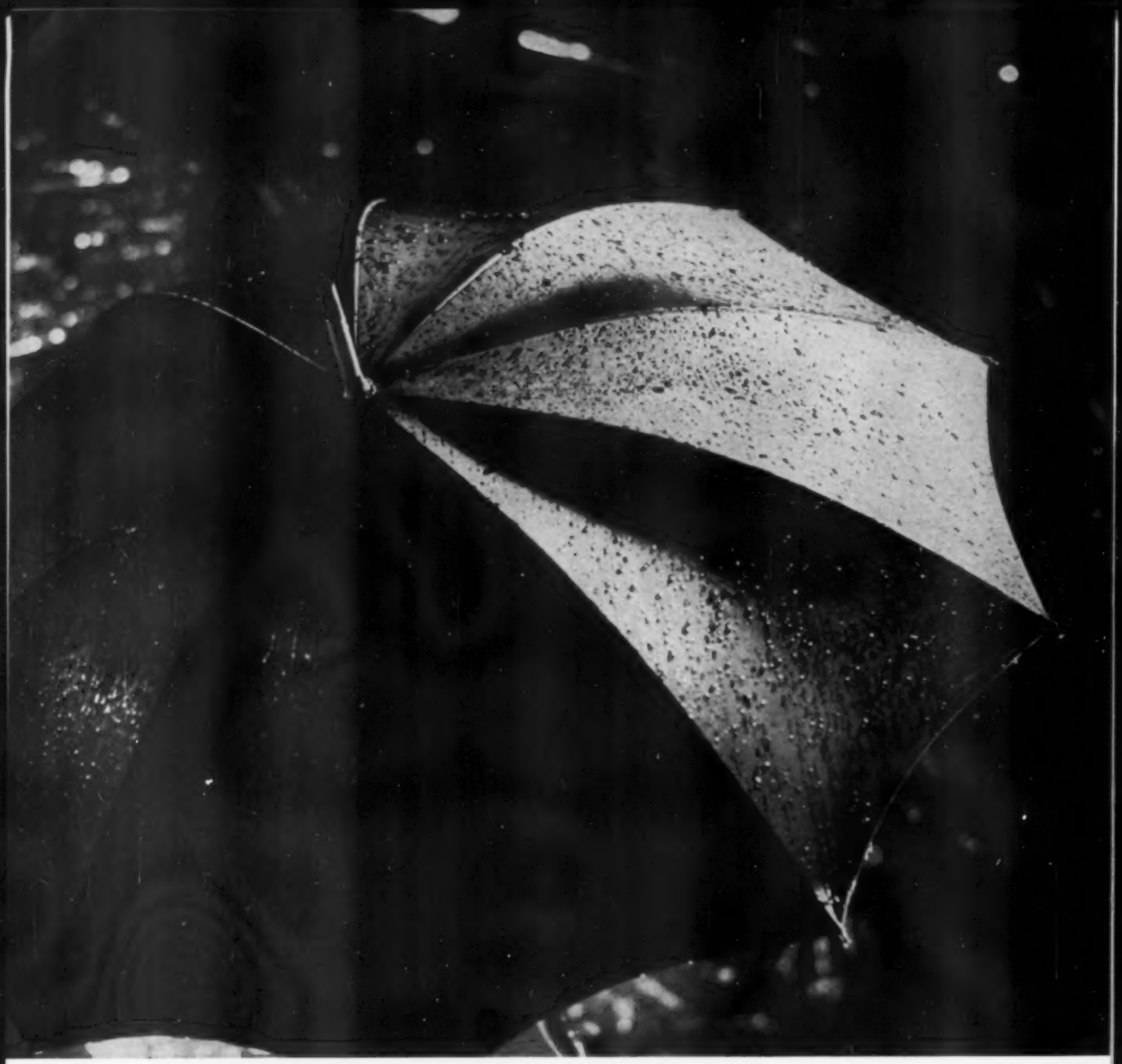
PROUD TO BE PART OF A PIONEERING INDUSTRY



GPE _ technological bumbershoot

Covering the advanced needs of industry and defense is today's biggest technological job.

GPE has brought together, under one umbrella, broad physical resources plus a remarkably creative group of scientists, engineers and technicians. Its co-ordinated skills, knowledge, experience and producing facilities cover more than a dozen industries.

Each company in General Precision Equipment Corporation works close to the frontiers of science in its specific fields. Working together, they have rolled up an impressive record of achievement in new and often uncharted technological areas.

If your needs are in controls, systems engineering or automation, you'll find some eye-opening answers in this highly integrated research, design, engineering and manufacturing group.

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The principal GPE companies cover needs of defense and industry in these areas: Audio-Visual, Automatic Controls and Automation, Aviation, Chemical Processing, Electronic and Electrical, Graphic Arts, Instrumentation, Marine, Motion Picture, Packaging, Paper, Petroleum, Photo Technology, Power Generation and Conversion, Printing, Steel, Television, Textile.

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Address inquiries to:
General Precision Equipment Corporation
92 GOLD STREET, NEW YORK 38, N. Y.

trols, heads the Atlanta area; R. E. Costin will manage the Dallas area; and W. B. Stoehr will manage the San Francisco area. They will report to H. F. Holtz, manager of the general sales division, Cleaver-Brooks Co.

Mitchell, Labaugh Boosted By Barrett Division . .

to district managers of industrial tar products sales of the division of Allied Chemical & Dye Corp.

D. A. Mitchell will cover the western part of the U. S., headquartered in Chicago. W. D. Labaugh will handle sales in the eastern part of the country, with offices in New York City.

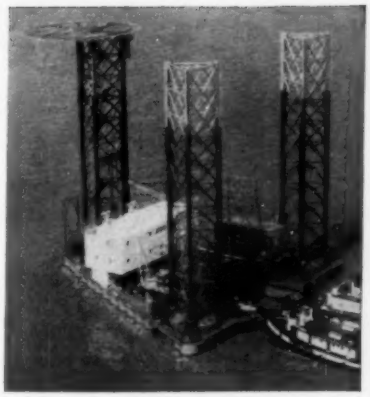
Mitchell entered Barrett's employ in 1940 as sales representative for its building products department. He was

D. A. MITCHELL

W. D. LABAUGH

transferred to creosote and pitch sales in 1944, and in 1956 was made assistant sales manager.

Labaugh was employed by Barrett in 1928 in the sales agency department. He subsequently served Barrett in administration, priorities, and purchasing departments, and in 1945 he joined the creosote and pitch department. He served as salesman and was assistant sales manager at the time of his recent promotion.



Newest Offshore Platform Christened at New Orleans

This 3-legged portable island joins the search for oil in the Gulf of Mexico, and soon will begin drilling off Cameron, La. Billed as an economy-size platform, it was manufactured by R. G. LeTourneau, Inc., of Longview, Tex., for Reading & Bates Offshore Drilling Co. of Tulsa.

McAdams Pipe & Supply Co. Moves to Larger Quarters . .

in Great Bend, Kans., to give better service to the oil and gas industry in the area. M. W. McClure is to be in charge of operations at Great Bend.

McClure started in the oil-field supply business at Rising Star, Tex., in 1922. He originally came to Kansas in 1935 having remained in various capacities, including district manager for Bridgeport Machine Co., Continental Supply Co., and Buckeye Supply.

The firm presently operates one other branch store at Morris, Okla., with general offices and store at Bristow, Okla.

Continental-Emsco Co. Salesmen Show Confidence . .

in the continued vigor of the oil industry during the 3-day sales meeting in Dallas recently. As a matter of fact, confidence in the industry was the keynote of the these 250 Continental-Emsco salesmen.

Walter E. Watson, vice chairman of the board, and A. S. Glossbrenner, president of The Youngstown Sheet & Tube Co., were guests at the meeting.

F. M. Mayer, president of Continental-Emsco and vice president of Youngstown, stated that the oil industry has been in similar situations in the past and has managed to weather the storms.

Business sessions were conducted by F. I. Brinegar, executive vice president, distribution, Continental-Emsco. A tour through the company's D+B plant at Garland, Tex., was held for the visting salespeople.

Continental-Emsco operates in oil areas

of the world and is a supplier-manufacturer of oil and gas equipment. Plants are located in Houston, Garland, Los Angeles, and St. Albans, England. It is a division of The Youngstown Sheet & Tube Co.

American Electronics, Inc. Receives License . .

to build and sell oil-field automation systems under patents held by Shell Development, a subsidiary of Shell Oil Co. H. Gershinowitz, president of Shell Development, and Arthur E. Lamel, president of American, jointly made the announcement.

The rights and information acquired include automatic well testing and automatic custody transfer of the production to the pipeline.

Oil Well Supply Division Names Walker, Deroche . .

as field representative in Houston, and field representative at Houma, La., respectively. The announcement came from M. F. Jones, Gulf Coast area manager.

Herman H. Walker entered the employ of Oilwell in 1954 at Houston. Joseph P. Deroche was employed at Houma in 1956.

and here's why: It absorbs water instantly from gases and liquids in either a static or flowing system, is insoluble and will not swell or disintegrate in water. FLORITE gives a low dew point depression, and agressively resists "poisoning effects" which permanently destroy adsorption qualities.

Let us prove that Florite is the most economical of the granular agents and best suited to your desiccant requirements, too. Inquiries receive prompt attention.

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Adsorbents
Desiccants
Diluents

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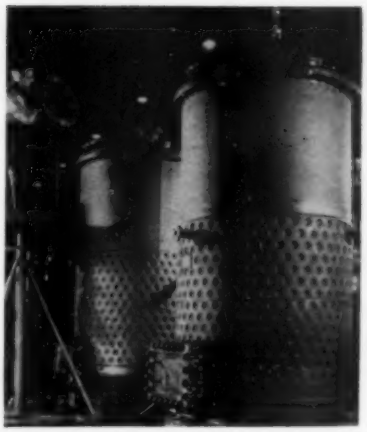


Pfaudler Co. Completes Two Herculoy Reactors

The dimple-jacketed units are of 970 gal. capacity and were designed for 150 lb. jacket pressure and 10 lb. internal pressure. Their maximum operating temperature is 239° F. The Herculoy is a No. 420 high silicone bronze alloy "A." Both reactors are 54 in. in diameter and 8 ft. high and were stress relieved at a temperature of 850° F.

Infilco, Inc., Assigns Thomas P. Hutchinson . .

HUTCHINSON

as representative of Infilco Ltd. in eastern Ontario, Quebec, and the Maritime provinces. E. G. Kominek, sales manager of Infilco, made the announcement. Hutchinson will headquarter in Montreal. He has been active in the industrial consultant and construction fields in Ontario and Quebec since 1945, and has been associated with several Canadian firms.

Roach Equipment Co. Appointed Distributor . .

of H. O. Trerice Co. temperature instruments in Oklahoma, according to J. L. Brackett, sales manager of the Detroit manufacturing firm. Roach will carry a full stock of Trerice instruments in Tulsa.

Harris Pump & Supply Co. Named By Proportioneers . .

as regional distributor for the division of B-I-F Industries, Inc.

Harris' 60 years of engineering experience will be available in West Virginia, southeastern Ohio, and

Western engineering of well completion and remedial practices utilizes the skills and efforts of engineers in **all** phases of well servicing.

For example, to insure greatest possible fracturing productivity, the Western Field Services Engineers will tailor the frac jobs to the requirements of your wells.

Working with all available well and offset information and experience, these engineers plan the fracturing treatments to adapt Western's many specialized products and services to your well conditions with a detailed treatment procedure.

Then field engineering takes over, seeing that the recommended treatment is carried out—with specialized equipment—to gain the most economical and profitable results.

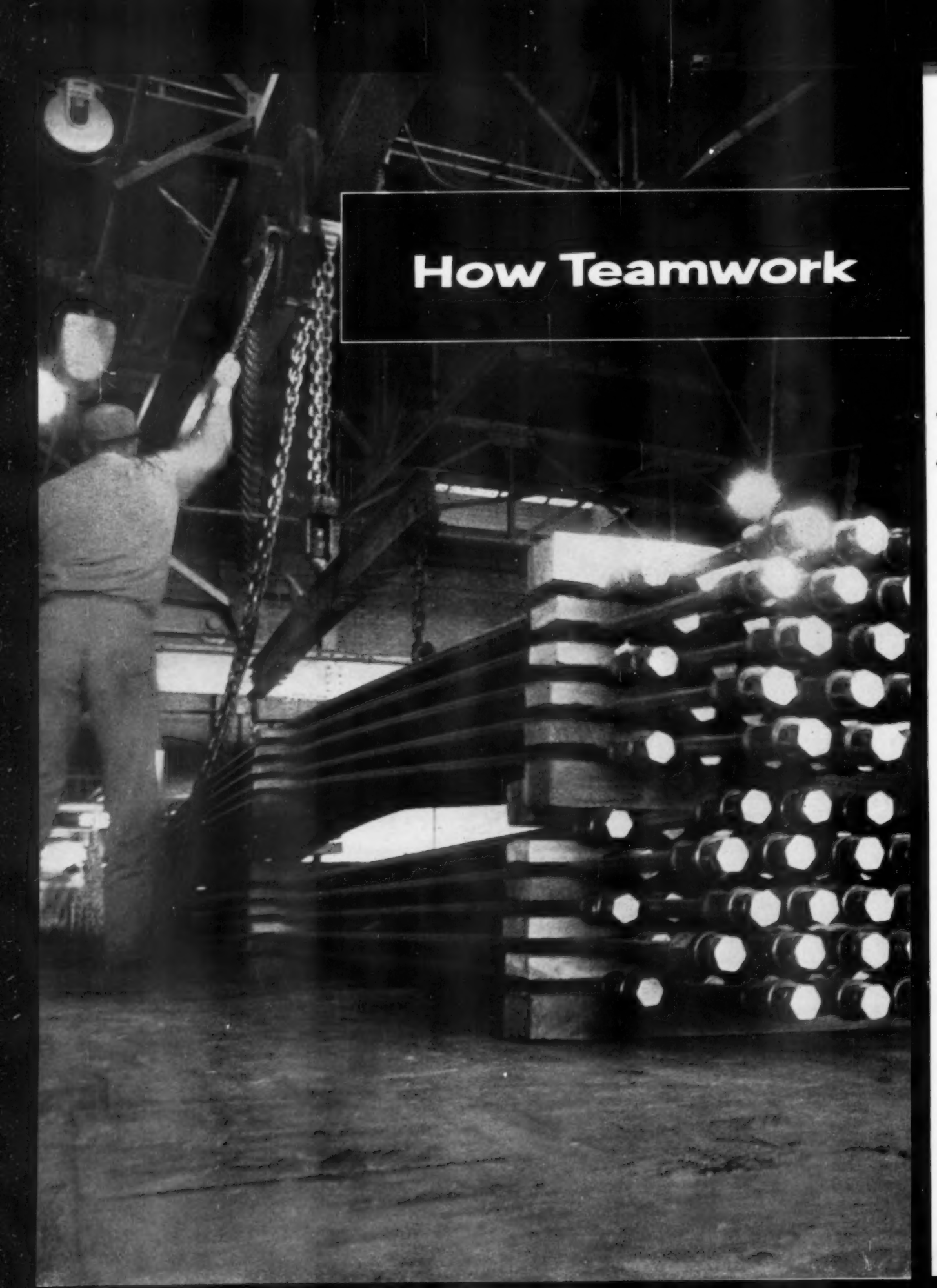
Your well servicing program can benefit from the engineering know-how of the Western Services Engineer. Get the many advantages of Western engineering in all completion and remedial work.

WESTERN ENGINEERING MAKES THE DIFFERENCE!

WESTERN Engineered WELL SERVICES

general offices: Box 310, Midland, Texas **THE WESTERN COMPANY**

Integrated wire line and pumping services for the Southwest: logging, perforating, fracturing, acidizing.


How Teamwork

Improves Rod Service

Here's how the J&L-Axelson team can help you get better sucker rod performance.

First, the experience and knowledge of the J&L man enables him to specify the correct size, type and grade of rods for the conditions in your well.

Second, the manufacturing skills developed by Axelson during sixty-six years in the business are your guarantee of uniform high quality. This means all the rods in an Axelson string do their share with no weak links to cause trouble now or later.

This brand of performance has made the J&L-Axelson team the standard for sucker rods throughout the oil fields of the United States and Canada.

Ask your local J&L Supply man for complete information on Axelson Sucker Rods or write us direct, Drawer 2481, Tulsa.

Jones & Laughlin

SUPPLY DIVISION – Tulsa

If it's sold by J&L....
It's the best available

7 features that mean
SUPERIOR SERVICE
LONGER LIFE

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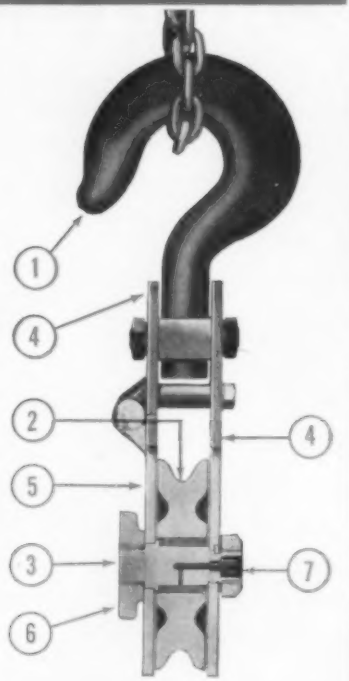
DROP SIDE SNATCH BLOCKS



25 TON CAPACITY
SIZES: 6", 8", & 10"

1. Drop-forged, heat-treated hook has 100,000 lb. capacity.
2. Forged steel sheave is precision machined and accurately gaged, assuring longer life for sheave and rope.
3. Extra heavy sheave pin and bearing for greater strength, smoother running.
4. ⅜" steel plate resists distortion.
5. Drop-Side (patented) is hinged for easier handling and stringing.
6. Wing nut, tightened or loosened with hammer, holds drop-side in place.
7. Zerk fitting for sheave pin lubrication.

To string or unstring, you remove wing nut, lift side, insert or remove line, drop the side and replace nut. Sheave cannot come off while side plate is raised.

8-1-58

WELL EQUIPMENT MFG. CORP.
HOUSTON, TEXAS

WECO

Division of CHIKSAN COMPANY *a subsidiary of* FOOD MACHINERY AND CHEMICAL CORPORATION

fmc

western Pennsylvania for users of the Proportioneers, Inc.'s line of chemical proportioning pumps.

American Iron & Machine Names Burner, Erisken . .

to the sales staff as special representative at Houston and area director, export sales, in Rome, Italy. Bert

LEROY BURNER

RAIF ERISKEN

Wheeler, sales manager for American Iron & Machine Works Co., Inc., made the announcement.

Leroy Burner has had experience with oil tool manufacturing companies from the supply store level to managerial capacities. Before joining American Iron, he was manager of machinery sales for a supply company.

Raif Erisken's territory will cover Europe, Middle East, and North Africa. He has experience in the export field and is well acquainted with the oil country people in the Eastern Hemisphere. Before joining American Iron, he was with Ideco, Inc., in New York as comanager of export sales in the Eastern Hemisphere.

Dick M. Koons Joins Otis Engineering Corp. . .

in Dallas as development engineer. Koons was formerly senior production engineer for Cia Shell de Venezuela in Maracaibo.

Manzel Division To Conduct Regional Conferences . .

for the field engineering and sales personnel. Manzel is a division of Houdaille Industries, Inc. Representatives from the Southwest will meet April 15 in Dallas. The eastern states field staff will gather at Cleveland, Ohio, on April 22.

Houdaille executives offices will be represented by Herbert H. Roosa, vice president and group executive. Granger B. Thurstone, Manzel general

For Cathodic Protection.. only ZINC ANODES

Have Long Life and are Self-Regulating

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Control paraffin in tubing, flow lines and tanks by the CONSTANT injection of BRAKESOL. This eliminates costly Paraffin removal methods. Reclaim tank bottoms with BRAKESOL.

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It's safe—can't jam and knock equipment around when you thread pipe by power drive. Automatically kicks out after standard thread is cut. Workholder sets to size *before* putting on pipe—other easier work features. See it at your Supply House!

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Men who know steel agree that flame-hardening is the best known process for producing uniform hardness in finished steel . . . and Harrisburg liners are the only liners sold today that are flame hardened. In test after test Harrisburg Diamond-Hard liners last longer under all operating conditions, thus reducing pump operating costs.

Harrisburg liners are precision manufactured from billet to the mirror-finished liner, assuring users of maximum strength and wear resistance.

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manager, and Robert W. Meyers, sales manager, will conduct the conferences. Engineering advances in the field of automatic force-fed lubrication and applications of slurry pumps in the petroleum industry will be discussed.

Midwest Piping Co., Inc. Elects O. P. Carter . .

O. P. CARTER

president with headquarters in St. Louis, Mo. He was executive vice president for the last 2½ years and succeeds Eric A. Kerbey, who died recently.

Before returning to St. Louis as executive vice president, Carter was manager of the company's New England division and East Coast construction for 10 years. He has been with the company for 28 years, starting as sales engineer.

Midwest Piping is a fabricator and erector of power plant and industrial piping systems. It also manufactures a a line of pipe welding fittings. Plants are located in St. Louis, Los Angeles, and Clifton, N. J.

W. S. Roberts, Jr., Appointed Manager . .

W. S. ROBERTS

of the new business division of Stone & Webster Engineering Corp., according to T. Cortlandt Williams, president.

Roberts will coordinate the new business activities of the company's offices in Chicago, Houston, Los Angeles, San Francisco, and Seattle.

Robert G. Burson Named By The Dayton Rubber Co. . .

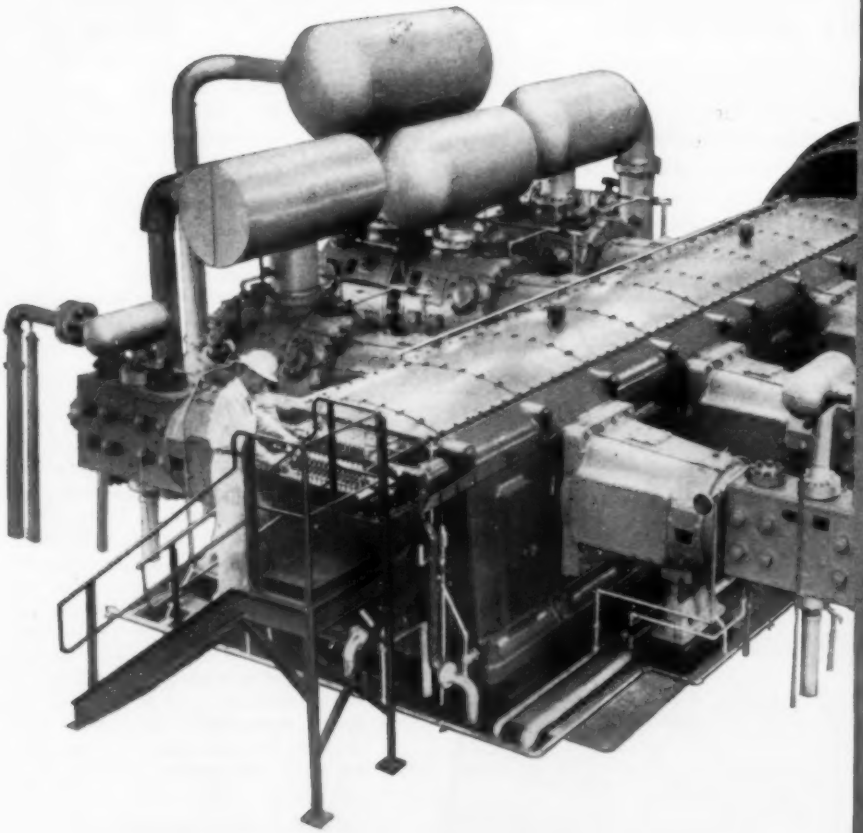
as assistant general sales manager for the mechanical goods division. L. C. Strobeck, vice president in charge of the division's sales, made the announcement.

In his new post, Burson will help cordinate sales, distribution, and merchandising programs for the mechanical goods line. This position was created because of the expanded scope of the division's activities, particularly the V-belt market.

Burson was sales manager for the company's industrial wholesaler divi-

America's most powerful compressor

THE 10,000 HP COOPER-BESSEMER LM



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- minimum maintenance requirements
- main frame of high strength Meehanite Metal
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- pistons can be removed without disturbing compressor piping
- extreme accessibility
- greatest availability for multi-stage, multi-service requirements

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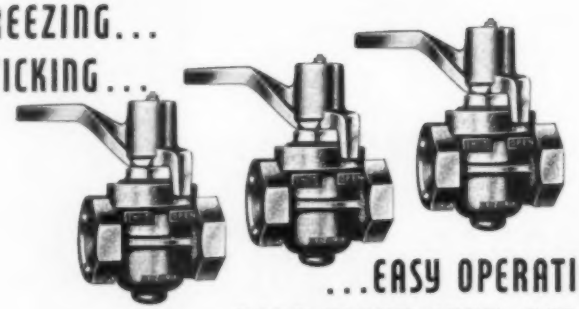

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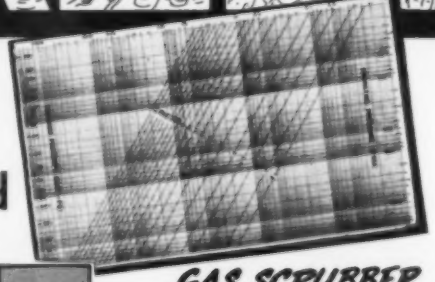

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sion. Prior to joining Dayton Rubber in January 1956, he was sales and advertising manager for a manufacturer of power equipment.

Dresser Manufacturing Div. Assigns D. V. Hackett . .

as gas market manager, according to Francis G. Fabian, Jr., general manager. In his new position, Hackett will manage sales of Dresser piping products to the gas industry.

D. V. HACKETT

Hackett, formerly district manager, gas, for Dresser in Chicago, replaced A. Newton Zahniser, who resigned. He joined Dresser in 1946. After working in the order and market research departments, he was appointed sales representative for western New York and Pennsylvania. Later, he served as district manager in Denver.

Dresser Manufacturing is one of the Dresser Industries.

Gardner-Denver Co. Elects R. J. Bauer . .

a vice president of the firm at its annual meeting. Regional manager of the oil field division, Bauer will continue to headquarter in Dallas, Tex. He has been with the company since June, 1923, working in the engineering department for several years before joining sales. He served in Chicago, Detroit, and St. Louis areas until 1934 when he became special representative in the Dallas office.

Gardner-Denver is a producer of pumps, rock drills, compressors, and air tools for petroleum, mining, constructions, and general industry.

Le Roi Sells Commercial Engine Business . .

to Waukesha Motor Co. The board of Westinghouse Air Brake Co. approved the terms of the agreement made by its Le Roi Division.

The line of internal combustion engines made by Le Roi, along with certain inventories, special tools, and equipment, make up the major assets involved in the transaction.

Frank Zielsdorf, general manager of Le Roi, stated that the removal of this engine line will permit the division to concentrate its efforts on the air compressor and tool business and to obtain a greater share of the markets for this type of equipment. He stated that the division will con-

A New Fracturing Service

HALLIBURTON'S SAND-ACID

Components	Sand and non-thickened Hydrochloric Acid
Additives	Inhibitors, non-emulsifying chemicals, and fluid-loss agents
Method of Field Mixing	Continuous
API Fluid Loss	Generally less than 40 cc when ALC-5 is added
Where Best Suited	Any formation subject to acidizing

Sand-Acid has been developed to combine the advantages of fracturing and acidizing for more effective production stimulation in lime bearing formations. This service permits the use of Halliburton's non-emulsifying agents designed to prevent the occurrence of troublesome emulsions. Low fluid loss... the secret to more effective fracturing is accomplished with Halliburton's exclusive ALC-5 additive.

Field results prove the effectiveness of Halliburton's Sand-Acid. Records of the first six wells treated in a Mid-Continent area show improved production with no secondary emulsion problems. Numerous other cases may be cited where Sand-Acid has given similar results.

For more information about Sand-Acid, call your Halliburton Fracturing Engineer. Ask him for your free copy of the *new* bulletin, "Elements of Hydraulic Fracturing" which describes all Halliburton fracturing techniques.

HALLIBURTON OIL WELL CEMENTING COMPANY
DUNCAN, OKLAHOMA

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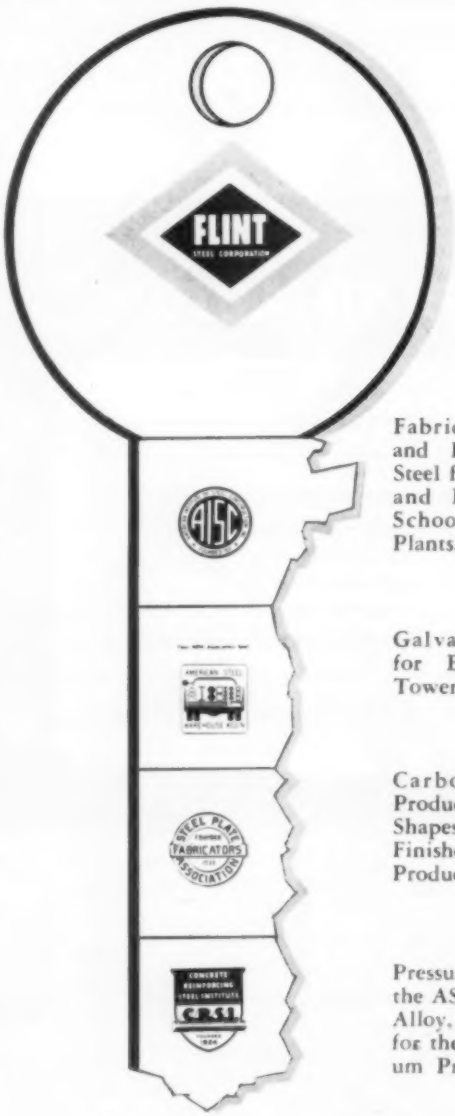

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for over 40 years

FLINT STEEL CORPORATION

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tinue to manufacture smaller gasoline engines in the 30 to 50 hp. sizes for use in powering its own products.

G. H. Draper Co. Named Sales Representative . .

G. H. DRAPER

in Houston for St. Louis Steel Casting, Inc. The announcement was made by Carl Binder, president of St. Louis Steel.

G. H. Draper, founder and owner of the distributing company is known among oil tool manufacturers, oil producing companies, and refineries in Texas, Oklahoma, and Louisiana.

Tretolite Co. Adds Four Engineers To Staff . .

of field personnel. Conrad P. Lozano, warehouse manager of stock location and laboratory facilities in Odessa, Tex., has been appointed field service engineer at Odessa. Frank J. Ortt, formerly with Sun Oil Co., Canadian division, becomes Tretolite's representative at Grenfell, Sask.

James H. Roberson, Jr., formerly with Kobe, Inc., has been assigned the Casper, Wyo., district. Robert E. Morgan, formerly with Houston Oil Field Material Co., Inc., has joined Tretolite as service engineer for the San Antonio district. He will be located at El Campo, Tex.

J&L Steel Corp. Now Making Grayloc Tubing . .

a specialty oil country product capable of withstanding the conditions found in the highest pressure wells. J&L is manufacturing the integral joint tubing under a licensing agreement with Gray Tool Co. of Houston.

Grayloc tubing features an effective high-pressure seal which has previously been

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Stand lifts, holds, tilts 55 gal. barrels Prevents spillage—easily loaded.

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PIPE FABRICATION
NEEDS...

FREE

16-page illustrated brochure shows Flori-Houston fabrication team, illustrates the equipment and processes used, and provides several interesting case histories of outstanding fabrication jobs. Write today for your free copy.

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ALL THREE
OF THE BIG THREE

The Right
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Here's why *your* cost for fabricated piping is lowest from Flori-Houston: By processing thousands of tons of piping per year, Flori-Houston's two huge plants offer you low shop costs, made possible only through mass production techniques.

Permanent shop craftsmen, instead of transient field workers, utilize the latest automatic equipment to further minimize your fabrication costs. With Flori-Houston, you can be sure the price is *right*.

Finest
QUALITY

A full-time piping metallurgist, using the physical and chemical facilities of the research and development laboratory, is an important factor in Flori-Houston's leadership in the expanding field of critical alloy piping.

Quality control is rigidly maintained at Flori-Houston by an inspection team responsible only to management, working with X-ray, magnaflux, dye check and other scientific techniques. Accurate dimensions are insured by close inspection of each piece before shipment, as shown in illustration (at left) of the checking floor.

Dependable
DELIVERY

Flori-Houston has unique delivery advantages because shipments can be made economically to most destinations from either of the two plants. Resulting flexibility virtually eliminates the delivery problems inherent in the normal single plant operation.

Massive Houston Plant, shown at left, with 560 x 106 feet of unrestricted floor area, gives idea of comprehensive Flori-Houston facilities.

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THE FLORI PIPE CO.
601 East Red Bud St. Louis 15, Mo.

HOUSTON OFFICE
HOUSTON PIPE & STEEL, Inc.
P. O. Box 2, Houston 1, Texas
Divisions of Spartan Corporation

used for connections on wellhead equipment. The threads of Grayloc tubing serve only to pull the joint together and to resist tension. This tubing is being marketed through Jones & Laughlin Supply Division in Tulsa.

Bucyrus-Erie Co. Transfers Its Drill Division . .

from South Milwaukee to this new plant in Richmond, Ind. Construction of the plant was completed recently.

Bucyrus-Erie said that the parts and tool section for well drills was moved April 1 and well drill sales section completed its transfer April 14.

The South Milwaukee plant will continue repair service for both drilling and fishing tools.

Preliminary manufacturing operations at Richmond already have begun. All engineering, manufacturing, and sales activities are located at the new site.

The 1-story plant covers more than 8 acres on a 148-acre site. Total floor space is 350,000 sq. ft.

Standard-Southern Corp. Appoints George Thorn . .

to the industrial sales division at Houston. Gerald Rauch, president has announced.

Thorn has been in the industrial supply field for 10 years, beginning his career as warehouseman and progressing to telephone desk sales. For the past 6 years, he has been calling on the petro-chem and construction firms operating in the Houston area.

Standard-Southern is a supplier of oil field, refinery, industrial, and petroleum construction materials.

Hillmac Adds Clifford M. Brake To Sales Force . .

of the new Casper Wyo., branch. Hillmac is a division of American Coldset Corp. Brake will cover the Farmington, N. M., area under the direct supervision of Sales Manager Ed Hanna.

His background consists of 19 years as production foreman of Pryor & Lockhart, Inc. From 1940 through 1947 he was sales promotion manager for The Brake Chemical Co. For the past 11 years he has been engaged in sales promotion work for John A. Roebling's Sons Co. in the Gulf Coast; BrakeSol, Inc., in the Mid-Continent

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Tough pumping conditions are duck soup to Ampco Metal. It's a two-fisted aluminum-bronze alloy that is specially engineered to guard against failure caused by corrosion, erosion, abrasion, and cavitation-pitting. It provides exceptional strength — yet it weighs 10-15% less than ordinary bronzes.

Check for this protection when you look at specifications of duplex and triplex pumps. And — insist on fluid ends of Ampco Metal for replacements on your old pumps.

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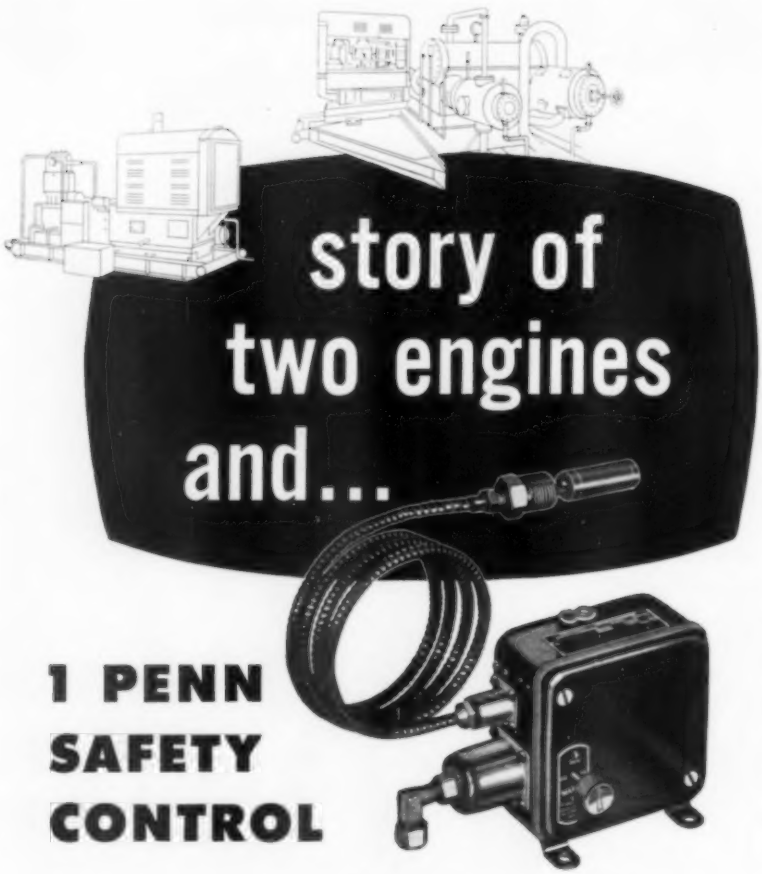

story of two engines and...

1 PENN SAFETY CONTROL

A damaged engine . . . lost production . . . wasted man-hours . . . an expensive repair bill! One superintendent had this expensive story to report . . . because a minor engine trouble went undetected and was allowed to grow into a major breakdown.

The other superintendent *played it safe.* A PENN Safety Control stood watch over his engine . . . ready to warn him the instant oil pressure dropped dangerously low or jacket water temperature rose too high. Little engine faults were speedily found and corrected.

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Battery ignition applications. Opens battery circuit and sounds an alarm . . . sounds an alarm only . . . opens battery circuit only.

Magneto ignition applications. Sounds an alarm only . . . grounds single or dual magneto . . . grounds magneto and sounds an alarm or lights a signal light.

Dual ignition applications. Opens battery circuit and grounds the magneto.

Diesel applications. Sounds an alarm only . . . closes magnetic fuel valve and sounds alarm . . . closes magnetic fuel valve only . . . closes magnetic fuel valve and opens pilot relay.

PENN CONTROLS, INC. Goshen, Indiana

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AUTOMATIC CONTROLS FOR HEATING, REFRIGERATION, AIR CONDITIONING, APPLIANCES, PUMPS, AIR COMPRESSORS, ENGINES

area; Republic Supply in Wyoming; and Magacobar in Wyoming and Billings, Mont.

Hycalog, Inc., Acquires Canadian Subsidiary . .

according to a recent announcement by J. R. Mayeaux, president. Located in Calgary, Alta., it will operate under the name Prairie Coring & Supply Ltd. William B. Crane is the manager.

The company will serve as distributor for the sales of Hycalog diamond coring bits, diamond drill bits, wash-over shoes, and diamond core barrels. It will also operate as a service company for diamond coring.

Power Pumps, Inc. to Sell Fort Worth Equipment . .

manufacturered by Fort Worth Steel & Machinery Co., in the Four Corners area. With a recently established store at Farmington, N. M., Power Pumps stocks a wide range of types and sizes of sheaves and V-belts.

The new distributorship agreement was announced jointly by Ralph W. Abbott, president of Power Pumps; Fremont Fisher, Fort Worth Steel & Machinery vice president for sales; and Earl Baker FWS&M district sales manager.

Jim Miller is the manager of the Farmington store. Home office of Power Pumps is in Long Beach, Calif. The firm specializes in engine, pump, and V-belt drive applications for the petroleum industry.

Baroid Names R. A. Wall . .

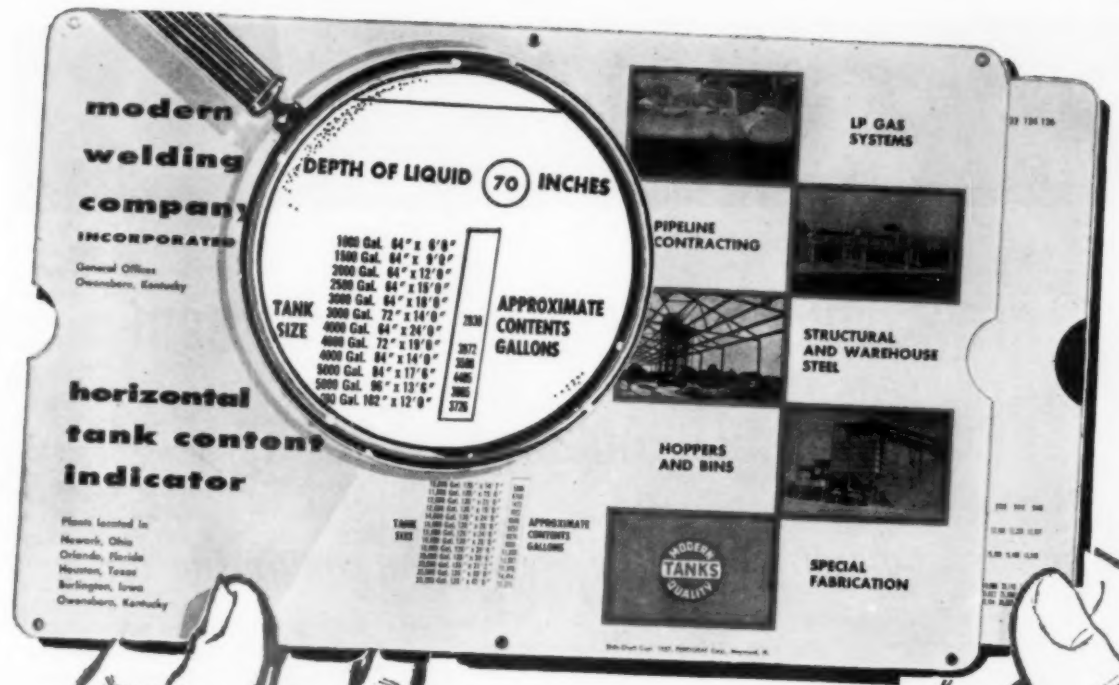
as assistant advertising manager, Baroid Division, National Lead Co.

Wall worked as assistant art director with Hall & Thompson, Inc., in Oklahoma City. He also worked with Lowe Runkle Co.

Polybond Corp. Established In New Orleans, La.

The new firm has developed methods of sealing leaks under pressures of as high as 300 psi. with petroleum-derived plastics, its president, Charles C. Lynch, said. The firm has branch operations in Baton Rouge, La., and Atlanta, Ga.

Application of any of more than 100 different types of plastic materials is done without the use of external heat, or the danger of explosion which



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Engineering Progress Report

FROM UNION CARBIDE CHEMICALS COMPANY

Prewashing of Refinery Gas Stream Reduces Diethanolamine Fouling

Gas sweetening cost reduced by preventing contamination

Most refinery gas treating plants using diethanolamine to remove hydrogen sulfide have operated for years with little trouble. However, there have been some instances where the solution has rapidly become fouled.

Laboratory analyses and actual field investigations have revealed that the formation of heat-stable salts is frequently a major contributor to solution fouling. Research has further shown that the formation of these salts can often be controlled by prewashing the gas stream. CARBIDE's Technical Service Department has helped achieve maximum operating economy for many ethanolamine users.

THE EXISTENCE OF HEAT-STABLE SALTS

Estimates of diethanolamine losses in treating operations are based on the observation that the solution progressively declines in capacity to accept acid gases. Analytic procedures suggest that the diethanolamine is not being physically lost from the system by leakage, vaporization or entrainment, but is being converted to heat-stable salts. Examination of many used diethanolamine solution samples from customers' plants has confirmed the presence of heat-stable salts of organic acids such as formic and acetic.

$$DEA + HCOOH \longrightarrow DEA \cdot HOOCH$$

$$DEA + CH_3COOH \longrightarrow DEA \cdot HOOCCH_3$$

THE FORMATION OF OTHER SALTS

In some cases, hydrogen cyanide also enters the treating plant in the gas stream and is combined with diethanolamine as a soluble salt in the absorber section, as are carbon dioxide, hydrogen sulfide, and other acidic components. Analyses of used plant solutions has confirmed the presence of ferrocyanides. It appears likely that they are formed by one or both of the following reaction routes.

1. $Fe(HCO_3)_2 + 6\ DEA \cdot HCN \rightleftharpoons 2DEA \cdot HCO_3 + (DEAH)_4Fe(CN)_6$

2. $Fe + 2H_2O \longrightarrow Fe(OH)_2 + H_2$

$$Fe(OH)_2 + 2HCN \longrightarrow Fe(CN)_2 + 2H_2O$$

$$Fe(CN)_2 + 4HCN \longrightarrow H_4Fe(CN)_6$$

$$H_4Fe(CN)_6 + 4DEA \longrightarrow (DEAH)_4Fe(CN)_6$$

PREVENTION OF SALT FORMATION

It is possible to minimize the contamination of amine solutions from organic acids by prewashing the gas stream with an alkali solution or water.

In an alkali prewash, some of the caustic will be converted quickly to sodium acid sulfide and sodium sulfide (or the corresponding carbonate salts) by the hydrogen sulfide (or carbon dioxide) in the gas. Nevertheless, the solution will still remove formic and acetic acids since these stronger acids will replace the weaker sulfides and carbonates.

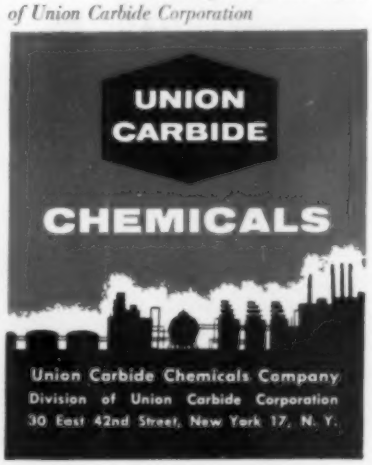
Caustic solutions may not be as effective in removing hydrogen cyanide as they are in removing formic and acetic acid from gas streams rich in hydrogen sulfide or carbon dioxide. This is because the sulfides and carbonates replace the weaker cyanides. The high water solubility of hydrogen cyanide (and the relatively low solubilities of hydrogen sulfide and carbon dioxide) makes water washing an alternate method of hydrogen cyanide removal.

Prewashing not only reduces fouling of the diethanolamine but is also beneficial because the contaminants that are removed may sometimes promote corrosion.

FURTHER STUDIES

Union Carbide Chemicals Company is continually engaged in research designed to improve the products and processes of the gas conditioning industry. The results of this research are readily available to the industry from CARBIDE's Technical Service Department. If you would like more information on CARBIDE's Technical Services to the gas treating industry, call our nearest technical representative or write, Union Carbide Chemicals Company, Room 328, Department B, 30 East 42nd Street, New York 17, New York.

"Union Carbide" is a registered trade-mark of Union Carbide Corporation



can result from conventional welding operations.

"Sealing of leaks by the application of the Polybond process can be carried on at about half the cost of usual methods, in about half the time, and in complete safety," Lynch explained.

Among the various types of work already performed by Polybond, he cited the complete relining of tank bottoms, sealing of seams in all types of petroleum storage tanks, often with products still being stored in the tanks, and repairs to leaking pipelines often under severe internal pressures.

J. B. Nichols To Inspect Foreign Operations . .

of Rogers Geophysical Co. this month. He will spend approximately 5 weeks in Europe with most of that time devoted to activities of Exploration Geophysique Rogers, the French affiliate.

Nichols has been general manager of Rogers since 1952. Rogers has 15 crews operating in Europe, the Africas, and South America and 3 crews operating in the U. S.

Leschen Wire Rope Division Names W. C. Germo . .

sales representative, according to an announcement by Gordon N. Dow, general sales manager. Leschen is a division of H. K. Porter Co., Inc. His territory will cover northern Illinois and southern Wisconsin, except the Chicago metropolitan area.

Germo was for 11 years a marine chief engineer on the inland waterways for Ohio River Co. He has also had experience in industrial selling. He will make his headquarters in Chicago.

Cutler-Hammer, Inc., Names Cook, Jones . .

J. M. COOK

as vice president in charge of marketing, and a senior vice president, respectively. Philip Ryan, president, made the announcement.

P. S. Jones, formerly vice president in charge of sales will retire at the end of the year. In his new position, J. M. Cook will assume direction of all sales functions for the firm.

Cook, joined the sales department in 1928. The following year he was assigned to the Milwaukee district sales office. In 1933 he transferred to

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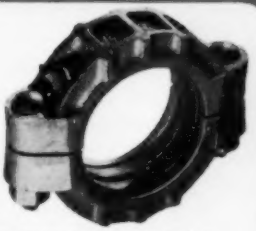

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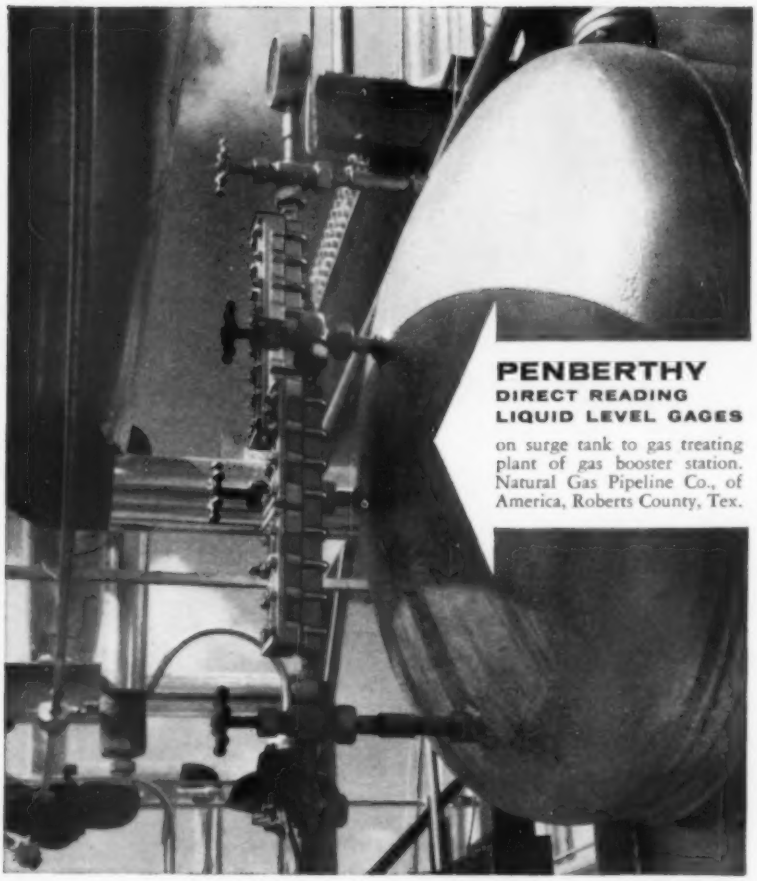

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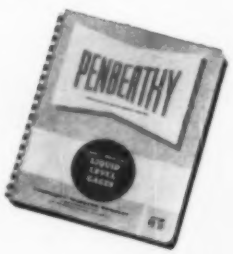

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the firm's Cincinnati district sales office and was there until 1944 when he became San Francisco district sales manager. In 1952 he was named sales manager, industrial control divisions, a position he held until his new appointment.

Master Tank & Welding Co. Appoints Ed Stafford . .

sales representative. The announcement was made by Sam Weempe, partner and general manager.

Stafford will represent domestic propane tanks, storage tanks, and transports in the LP gas industry. He will headquarter at the Master plant in Dallas, Tex.

Tidewater Marine Announces Venezuelan Subsidiary . .

named Tidewater Marine Service, C. A. It was acquired by purchase of 60% interest in Servicios Maritimos, C. A., (Semarca), a firm providing marine service on Lake Maracaibo. The Tidewater fleet stands now at 45 vessels. In April 1955, an incorporated group of 10 individual investors took delivery of their first boat. Ten months after this start, it became apparent to the investors that a stronger corporate structure was required to transform the venture from a limited exploitation into a continuing corporate enterprise.

Tidewater Marine Service, Inc., was formed in February 1956. Its aim, in the words of President John P. Laborde, is to provide equipment of efficient design and a reliable operating service to oil companies and drilling contractors wherever they undertake overwater exploration.

Management of fleet operation, maintenance, and personnel is the responsibility of Marine Superintendent William J. LeBlanc, a veteran of off-shore marine work.

Newest members of Tidewater management team are Carl S. McClaren and Howard Hogue, president and executive vice president of the new Lake Maracaibo subsidiary. McClaren, formerly a member of the engineering section of Todd Shipyards, had 10 years experience of marine operation on the lake as marine operations superintendent of C. A. Maracaibo Towing Co.

Hogue, until recently manager of the Latin American division of Lufkin Foundry & Machine Co., International, has spent his entire business career in the oil-field service industry.

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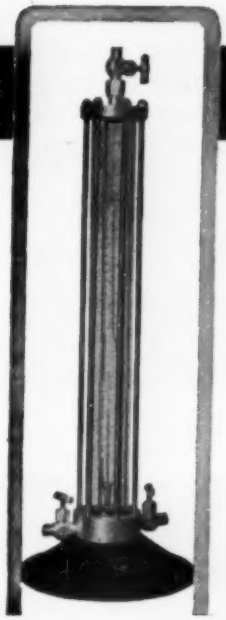

For obtaining specific gravity of liquefied petroleum gases, such as propane and butane, which under normal atmospheric pressure would evaporate into a gaseous form. Jar withstands operating pressures of 200 psi at normal temperatures. Equipment consist of clear lucite tube, aluminum end caps held by tie-rods and a conical base. Three needle valves allow entry of the sample and adjustment of the liquid level.

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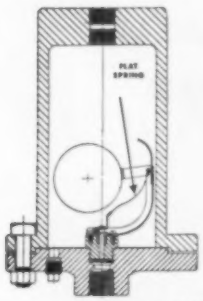

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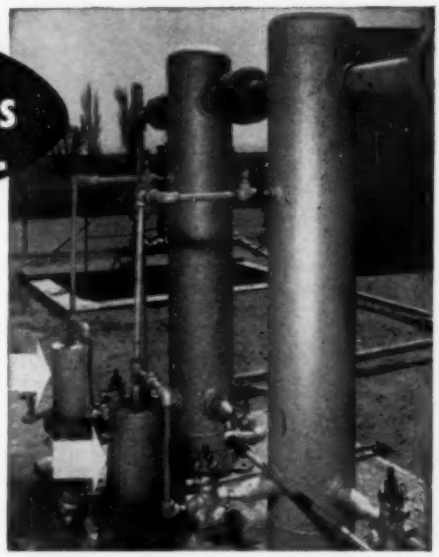

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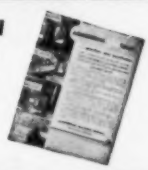

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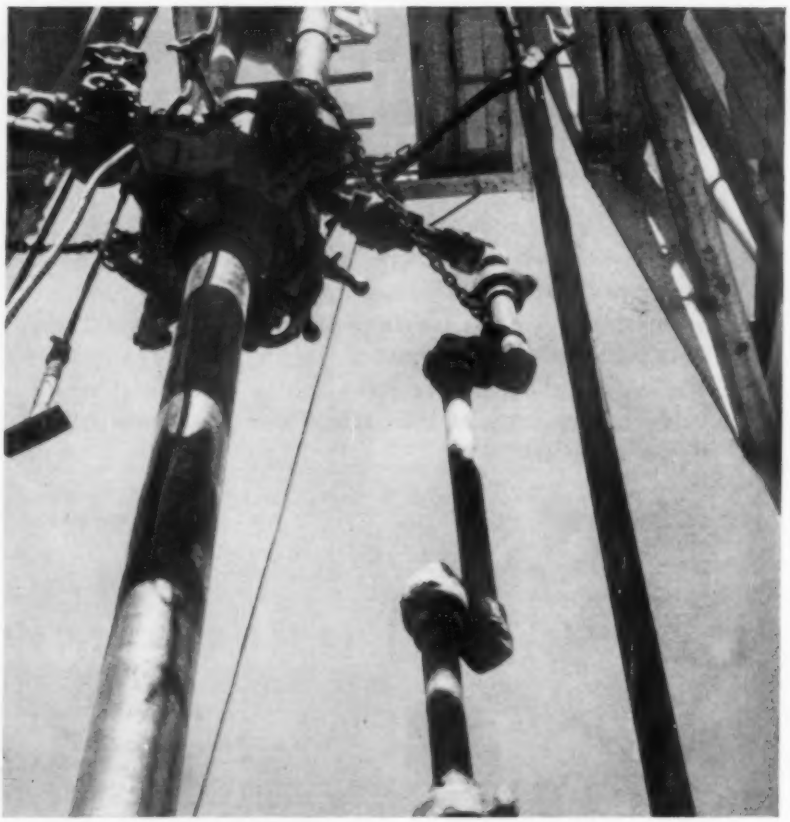

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THREE LUSH GAS STRIKES in Alberta's Grande Prairie region prove the adage that "the third time is the charm."

Return to Grande Prairie nets big gas strikes

BY JOHN C. McCASLIN

A FAST MOVING gas play in western Alberta indicates that major multi-pay gas reserves may lie under a large portion of the Grande Prairie region. The rapid-fire success of three wildcats in this area in the past few weeks also shows that the wildcatters never give up.

The third time . . . Triad Oil Co., the Foothills' most active oil and gas hunter, brought in three new gas reservoirs on a huge 700,000-acre farmout from Pan American Petroleum Corp., which in turn, had the block under original farmout from Scurry-Rainbow and Banff Oils. Triad hit gas at Big Mountain Creek, Haglund, and Grovedale—right in the middle of a vast area of previous exploration.

It will be remembered that Bailey-Selburn Oil & Gas Co., Ltd., et al carried out a busy exploratory program in this region a few years back. They found oil in the Cardium sand at Cutbank. Two wells were cased and tested, but commercial production failed to show, and the wells now are standing.

Then, Pan American moved into the region, found some gas at Chinook Ridge, but weren't too successful. After Pan American finished its program in the area, it farmed out its acreage to Triad. Triad set out on a five-well program, hit at three, and is drilling at two others.

• **Big Mountain Creek.** The Triad A-1 Big Mountain Creek discovery, 30 miles southwest of the town of Grande Prairie, flowed 13,000 M.c.f. of gas per day from the Permo-Penn at 10,444-10,504 ft. This is one of the biggest Permo-Penn strikes in Alberta—and the deepest.

The Big Mountain Creek wildcat was first drilled last year by Pan American, but was suspended. Pan American did find some gas in the Gething on drill-stem tests.

• **Haglund.** Triad's 6-25 Haglund discovery, a scheduled 10,000-ft. test, flowed 6,500 M.c.f. of gas per day from the Cadotte-Lower Cretaceous at the 8,170-ft. mark. The Haglund success lies northwest of Pan American's Chinook Ridge discovery.

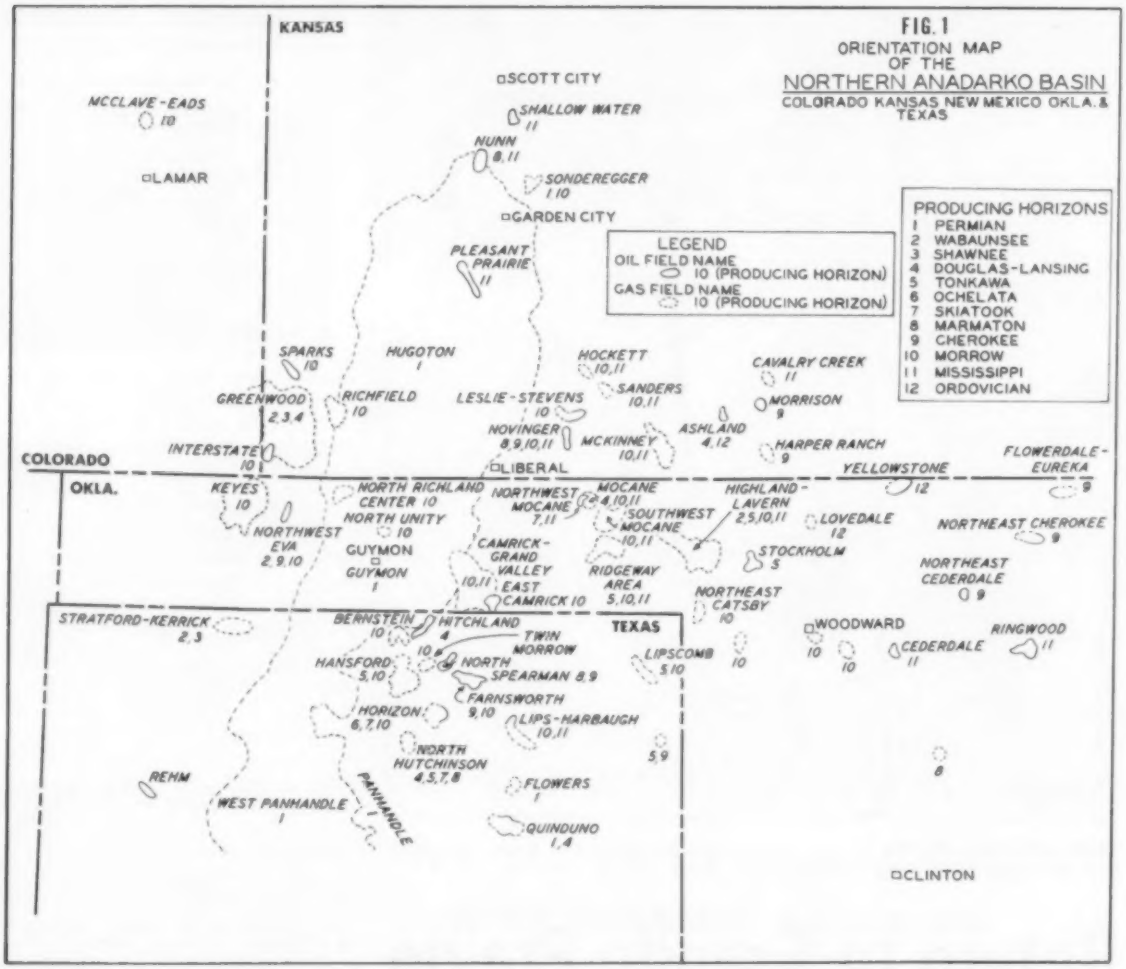
• **Grovedale.** The Triad 6-8 Grovedale strike, northeasternmost of the three discoveries, is a Cadomin-Lower Cretaceous hit. Gas flowed at the maximum daily rate of 6½ M.M.c.f. Cadomin was topped at 8,000 ft.

. . . Other tests. Triad is also busy drilling at another pair of wildcats on its large acreage spread. One is the 6-16 Hazelmere, located in the northwest corner of the land block; the other is the 6-15 Chinook in the extreme southwest corner of the spread.

Spring arrives . . . Spring thawing conditions are moving into western Canada. The three Triad strikes must wait till winter for confirmation tries due to the muskeg. Operators are working around the clock now to finish up operations at Big Mountain Creek, Grovedale, and Haglund, before the region becomes impassable.

A gas year . . . This appears to be a good gas discovery year for Alberta. Gas discoveries are popping up along the entire length of the Rocky Mountains from the U. S. border to British Columbia. The first 3 months of drilling in Alberta this year are studded with a series of highly important and prolific gas strikes, the biggest of them in the Foothills . . . Panther River, Lovett River, extensions to the big Waterton Park-Castle River field in the southwest, and now near the close of the muskeg drilling season . . . Grande Prairie.

All of these flush new gas strikes feed the demand for export of Canadian gas which is being advocated by a majority of the country's operators. The new gas strikes also are opening vast new areas to exploration in Alberta, both in the Foothills and in the high plains. When winter returns to Grande Prairie we can look for more action in this virgin province.



In this busy pre-Permian province

Operators in the Anadarko hit nearly one out of two

BY WAYNE E. SWEARINGEN and ARNOLD C. HAYDEN
Alex W. McCoy Associates, Inc.

THE Northern Anadarko basin (also known as the Hugoton embayment) includes southwestern Kansas, southeastern Colorado, northwestern Oklahoma and the Oklahoma and Texas panhandles. Embracing approximately 45,000 sq. miles, it is bounded on the south and southwest by the Amarillo uplift, on the west and northwest by the Sierra Grande and Las Animas arch, on the northeast by the west flank of the Central Kansas uplift and on the southeast by the Anadarko trough.

Fig. 1 is an orientation map showing the major oil and gas fields in the area and the zones from which these fields are productive. Some of the formation names are grouped for convenience.

The Permian sediments which are productive of gas in the giant Hugoton field are not at this time a primary target for exploratory drilling, although they yield most of the current income.

The Morrow sandstones of Lower Pennsylvanian age are productive of oil and gas in approximately 157 fields. Of this number, many are under active development and at this

This paper was presented at the spring meeting, Mid-Continent division, Division of Production, API, at Oklahoma City, April 1958.

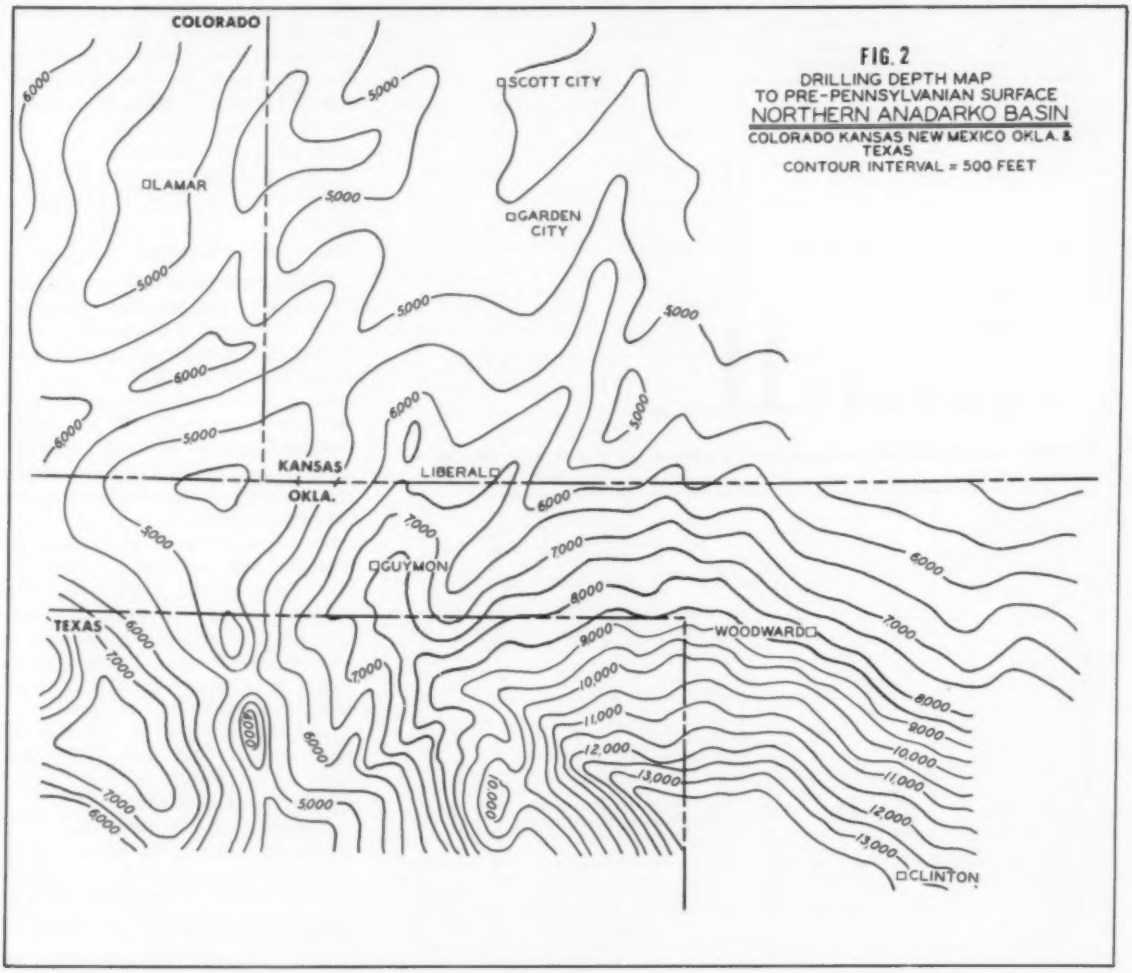


FIG. 2
DRILLING DEPTH MAP
TO PRE-PENNSYLVANIAN SURFACE
NORTHERN ANADARKO BASIN
COLORADO KANSAS NEW MEXICO OKLA. & TEXAS
CONTOUR INTERVAL = 500 FEET

subsurface geology is the best approach

time contain only one or two wells. Excellent success ratios and high reserves per well have been experienced in Morrow exploration. Although the Morrow is by far the best objective, several other zones in the geologic section are economically important and serve to improve the overall wildcat success.

In addition to the Morrow, some of the better pays are the Tonkawa sandstones, Shawnee limestone and Wabaunsee sandstone and limestone. Although the Mississippian sediments are productive in about 50 fields, these reservoirs are among the least profitable.

Fig. 2 shows the depth to the pre-Pennsylvanian surface. Over most of the northern Anadarko basin this surface is Mississippian in age, but in the south-southwestern portion of the area, it ranges in age from Mississippian to Precambrian. The missing sections are due to erosional trunca-

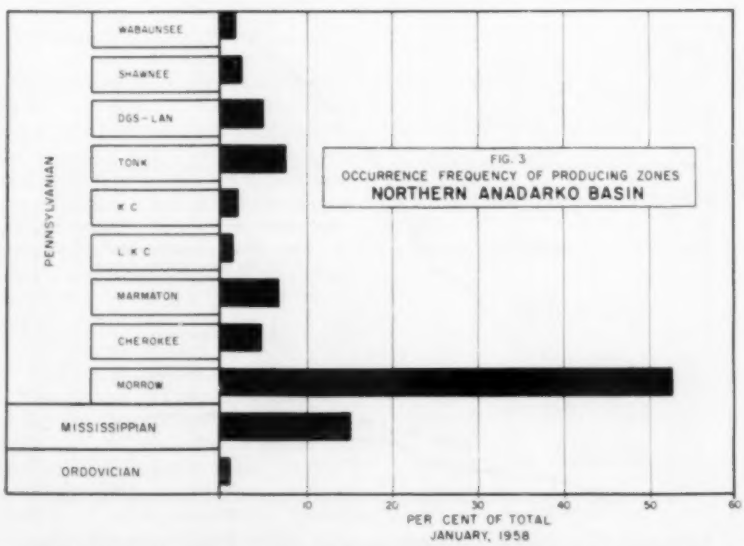
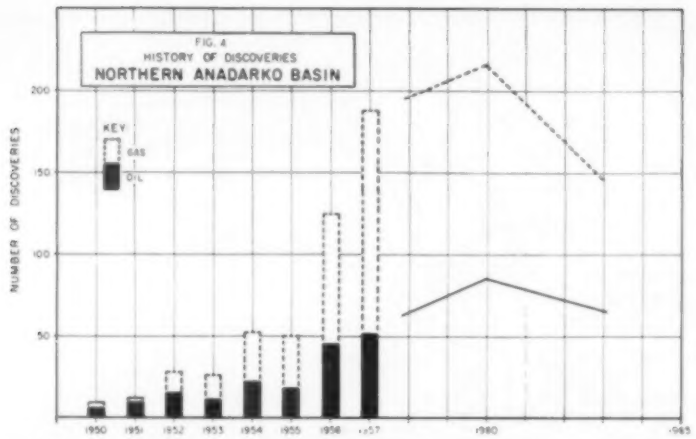
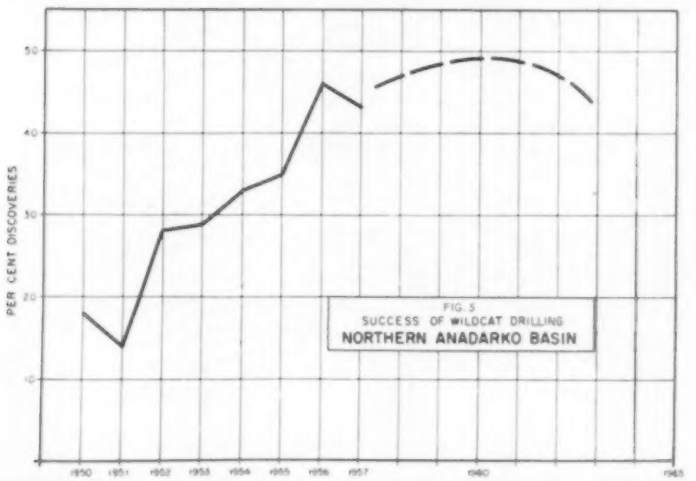


FIG. 3
OCCURRENCE FREQUENCY OF PRODUCING ZONES
NORTHERN ANADARKO BASIN

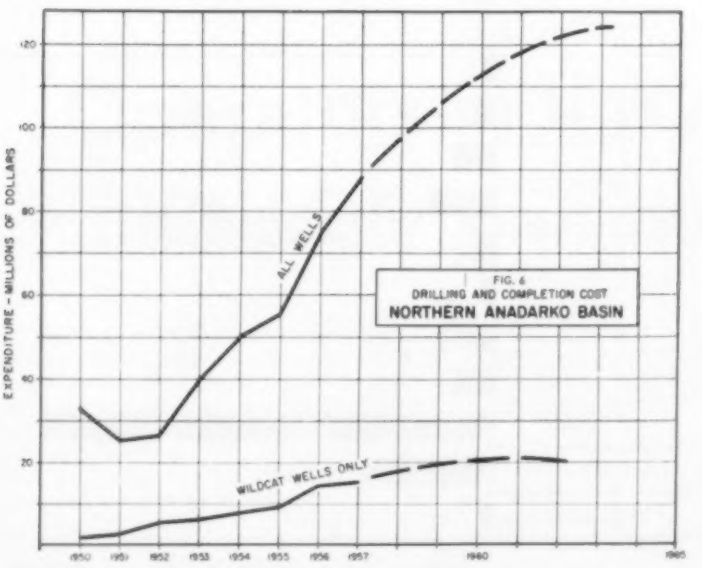
PRODUCING-ZONE frequency, showing percentage of total for each zone. Fig. 3.



HISTORY OF DISCOVERIES indicates recent upswing in gas discoveries. Fig. 4.



"WILDCAT" in the chart above refers to any test more than 1 mile from production. The wildcat success runs to nearly half the tests at present, although most discoveries so far have been in traps. Fig. 5.



COST of drilling wells has steadily mounted until it is near $100,000. Lease and pipeline costs are not figured in these calculations. Fig. 6.

tion associated with the uplift of the Amarillo Mountains.

Most operators set up a wildcat drilling program to test the Morrow. The underlying Mississippian can also be tested at low added cost. This program has resulted in a relatively large number of fields producing from Mississippian as well as Pennsylvanian rocks.

Geology

Every geologic system is represented within the northern Anadarko basin. Patterns of sedimentation in the Pennsylvanian and Mississippian rocks are comparable to those in other basin-embayment provinces. In the deeper portions of the basin these sediments consist of thick sequences of shale, grading shelfward into a thinner sequence of sandstone lenses enveloped in shales.

In the shelf areas, these units are thin persistent carbonates. At or near these facies changes stratigraphic traps are often found. The lateral gradation of the Tonkawa sandstones to Lansing limestones is one striking example of such a facies change which is not yet thoroughly explored.

The electrical logs in this area are good tools for quantitative determination of net porous thickness, porosity and water saturation.

The frequency of the occurence of producing zones in the area is shown on Fig. 3. More than one zone is productive in most of the fields and each zone is counted as to its percentage of the total.

Fig. 4 shows the history of discoveries. For the past 6 years there have been more discoveries of gas than of oil. This will probably continue until more of the larger gas fields are found.

Fig. 5 shows the success of wildcat drilling. Despite the fact that the preponderence of oil and gas thus far discovered occurs in stratigraphic or structural-stratigraphic traps, the wildcat success is nearly 50%. The success ratio may be expected to improve slightly as better subsurface control is available. These ratio figures are open to the usual question of definition as to both the terms "wildcat" and "discovery." In this area the word wildcat is generally applied to any test more than 1 mile from production. In any event, the ratio is well above the industry average and this will no doubt be the case for several years.

Drilling Costs

Fig. 6 shows the total expenditure for drilling and equipping the wells. These estimates are based on $8 per foot for wildcat wells and $11 per

foot average for all wells drilled. Based on these rough estimates the annual expenditure for wells will soon reach $100,000,000. The costs of leases and pipelines are not included.

Profitability

Table 1 shows some average ranges of reservoir data from the zones proven productive in the area. Gas recovery, expressed in million cubic feet per acre-foot, may be approximated by multiplying porosity times depth in miles times 30. Condensate, recoverable in lease separation equipment, will average about 10 bbl. per 1 M.M.c.f. of gas.

Primary oil recovery, in barrels per acre-foot, may be approximated by multiplying porosity times 10. Successful pressure maintenance or secondary recovery should result in twice the recovery of oil from most of the sandstone and many of the carbonate reservoirs.

The principal targets for wildcat drilling are the sandstone reservoirs in the Morrow.

If the Morrow sandstone is found to be 25 ft. thick and productive of gas, a reserve of about 10 billion cubic feet of gas and 100,000 bbl. of condensate may be expected from wells drilled on a spacing pattern of 640 acres. At 16 cents per thousand cubic feet and $3 per barrel, the ultimate gross revenue will be $1,900,000 per gas well.

If, on the other hand, oil is found and the wells are drilled on 40-acre spacing pattern, the recovery (by primary methods) will be about 150,000 bbl. of oil. The ultimate gross revenue (primary) therefrom will be $450,000 per well.

In either case, a good return is possible on an investment of about $100,000 to $150,000 per well, but the gas well is obviously more profitable. Wider spacing for oil wells should be encouraged.

Prospects for economic success are excellent and the current drilling activity is a reflection of this fact. There are now 85 wildcats being drilled or staked. The wildcat completions to March 20, 1958, include 47 gas discoveries, 12 oil discoveries and 64 dry holes. The success in 1958 is 48%.

Forecast

It appears that there will be continuing intense exploratory effort directed toward the Morrow sandstones, with the shallower Pennsylvanian zones as important secondary objectives.

Most of the oil and gas in this area is found in stratigraphic traps. Because of this, subsurface geology is the best exploratory method. As more subsurface control has become available, the ratio of wildcat success has improved and should continue to improve for a few years.

Relatively few development wells have been drilled because there are not yet adequate marketing outlets for gas and condensate. As the proposed pipelines are built, the rate of development drilling will increase, and the area should receive an even greater share of the petroleum industries budget for the next several years.

TABLE 1—RESERVOIR DATA, NORTHERN ANADARKO BASIN

		Type Rock	Net Pay Thickness Range	Porosity Percent	Connate Water Percent
PERMIAN		Carbonate	50-200	6-16	25-45
PENNSYLVANIAN	WABAUNSEE	Sandstone Carbonate	30- 50 10- 75	12-18 8-16	25-45 25-45
	SHAWNEE	Carbonate	10-75	8-16	25-45
	DGS-LAN	Carbonate	10-20	8-12	30-50
	TONKAWA	Sandstone	10-20	14-20	20-40
	K.C.	Carbonate	10-20	8-16	25-40
	L.K.C.	Sandstone Carbonate	20-40 10-20	12-16 8-16	25-45 25-40
	MARMATON	Carbonate	10-30	10-22	20-45
	CHEROKEE	Sandstone Carbonate	10-30 5-20	12-18 8-12	20-40 25-45
	MORROW	Sandstone	5-80	12-20	25-50
MISSISSIPPIAN		Carbonate	10-35	6-14	25-45
ORDOVICIAN		Sandstone Carbonate	- -	- -	- -

B. C. wildcat is tamed

NORTHEASTERN British Columbia's gas campaign picked up two new discoveries — one at Halfway River, the other at Boundary Lake.

Sinclair Canada's B-5-1 wildcat in the Halfway River region, 93 miles northwest of Fort St. John, is a Mississippian gas strike. The now-famous wildcat, which blew wild last year, killing one crew member, injuring others, and destroying the rig, made 8,800 M.c.f. of gas per day on a late drill-stem test. The test was run of a 45-ft. interval bottomed at 8,635 ft. Drilling continues.

The Boundary Lake area discovery is Pacific Petroleum's 12-10 Boundary Lake wildcat. It found gas in the Gething and Cadomin. Location is 27 miles northeast of Fort St. John—close to oil production in the Boundary Lake-Triassic oil field itself.

What will future exploration in Alberta reveal?

In Oklahoma . . .

Strikes abound, fatten Pennsylvanian coffers

NORTHWESTERN Oklahoma's Beaver, Ellis, and Woodward counties continue to lead the exploratory pace on the northern shelf of the Anadarko basin. This new oil and gas province is one of the most attractive and rewarding new regions in the country.

THREE DISCOVERIES in northwestern Oklahoma plus continued high-level development throughout the entire region make this one of the most active and attractive provinces in the country.

The success story in this region is not new—it is a program that has been in full swing for several years, but the tempo is picking up this year with new strikes in important link areas and in entirely new sections far removed from production. The latest additions to this rapid-fire play are in Beaver and Ellis counties.

Beaver County . . . This Oklahoma Panhandle county has one of its best oil discoveries in many months at The Texas Co.'s 1 Barby in NW NW 10-1n-22eCM.

The Pennsylvanian discovery flowed 532 bbl. of oil per day on final test of perforations at 6,032-46 ft. from a zone thought to be either Checkerboard or Kansas City. Followup drilling is expected to be swift. The wildcat is located in a barren area of the county's producing region. It lies east of oil production at Camrick and southwest of Elmwood oil field. Its success opens a vast new area for potential production along the southern edge of Beaver County.

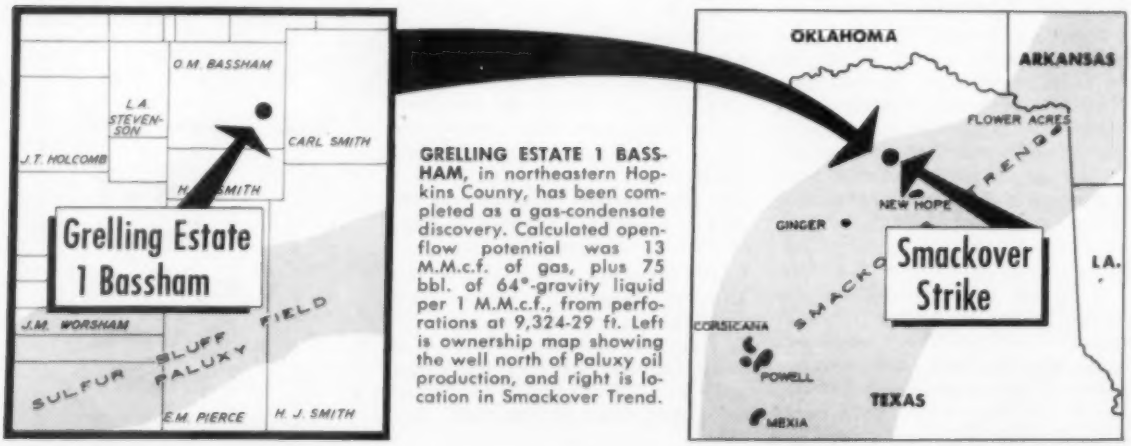
. . . Highland area. The other big strike in Beaver County is Republic Natural Gas Co.'s 1 Nine in SW NE 21-3n-27eCM, southwest of the fast-growing Highland - Laverne district. This well flowed more than 25 M.M.c.f. of gas per day from the Hoover-Pennsylvanian sand at 4,592-4,612 ft., and 8 M.M.c.f. per day from the Tonkawa-Pennsylvanian at 5,619-28 ft.

In Highland field itself big wells are being added weekly. Shell Oil Co.'s 1-19 Moore, SE NW 19-3n-28eCM, flowed 56 M.M.c.f. of gas per day from the Hoover at 4,466-90 ft. Wildcat tests now under way in Beaver County make it the most active area in the Panhandle.

Ellis County . . . This northwestern Oklahoma county has its fourth producing area as a result of Pan American Petroleum Corp.'s success at 1 Schoenhals in SE NW 23-20n-25w. Final production test in the Morrow-Pennsylvanian sand at 10,745-47 ft. was 75 bbl. of distillate per day and 5,700 M.c.f. of gas per day. This is the deepest production in northwestern Oklahoma. This is Pan Am's third strike in the county in recent months.

Other areas . . . Other northwestern Oklahoma events include a new discovery in Woodward County (not shown on map). Calvert Drilling Co. completes its 1 Young discovery in NE NE 17-24n-18w, 15 miles northeast of the city of Woodward, opening the county's seventh producing area. The well flowed 9 M.M.c.f. of gas per day from Chester-Mississippian perforations at 6,729-37 ft.

Here's a closeup look at . . . East Texas' new discovery



GRELLING ESTATE 1 BASSHAM, in northeastern Hopkins County, has been completed as a gas-condensate discovery. Calculated open-flow potential was 13 M.M.c.f. of gas, plus 75 bbl. of 64°-gravity liquid per 1 M.M.c.f., from perforations at 9,324-29 ft. Left is ownership map showing the well north of Paluxy oil production, and right is location in Smackover Trend.

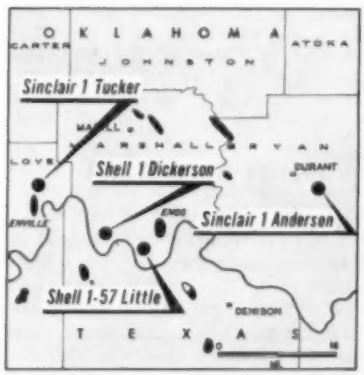
Fifth Well Born In Catesby Field

NORTHWESTERN Oklahoma's Catesby field, Ellis County Morrow producer, added its fifth well last week.

Pan American Petroleum Corp. 1 Moyer, C NW SE 19-24n-25w, flowed 16 bbl. of distillate per million cubic feet of gas (861 M.c.f.) per day from Morrow sand perforations in four 1-ft. intervals; 7,895, 8,013, 7,997, and 8,017 ft.

This comparatively new Morrow gas-distillate field is located in the northwest corner of the county and has proved itself one of the best new discovery areas in this section of Oklahoma.

It lies just a few miles south of big Laverne-Highland gas district, another Pennsylvanian producer.



DEEP and shallow discoveries in extreme southern Oklahoma promise a new drilling campaign for the Red River area.

Sooner interest moves south

BOTH DEEP AND SHALLOW discoveries in extreme southern Oklahoma have shifted exploratory interest into the Love, Marshall, and Bryan County areas.

Four strikes of considerable importance have put new impetus to the search for Ordovician, Silurian-Devonian, and Pennsylvanian oil in this complex section of the Ardmore basin.

The deep . . . Sinclair Oil & Gas Co. has an indicated discovery near the prolific Southwest Enville area in Love County. The 1 Tucker, NE NW SW 32-6s-3e, is a tentative Ordovician strike. Sinclair is preparing to test a 54-ft. section of Oil Creek sand below 10,600 ft. Successful completion of this well, located north of the Enville area, would be a major addition to the growing chain of deep

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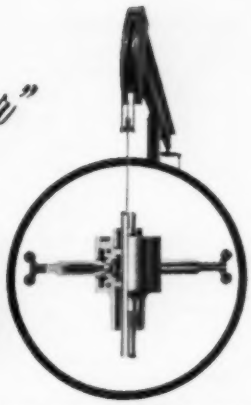

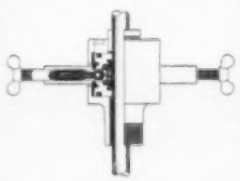

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Ordovician fields in the Ardmore-Marietta basin area.

The other deep discovery in southern Oklahoma is Sinclair's 1 Anderson near Durant in Bryan County. The well is entering the Oil Creek sand for a look after finding shows in the Hunton, Viola, Bromide, and McLish sands. This possible discovery is in virgin wildcat country at the extreme southeast corner of the basin. Nearest production is at famous Cumberland field about 15 miles northwest.

The shallow . . . Shell Oil Co. has two important shallow discoveries in southern Oklahoma—one at 1 Dickerson in SW SW 35-7s-4e, Marshall County; the other at 1-57 Little in SE NW 15-8s-5e, Marshall County.

The Dickerson discovery is a shallow Pennsylvanian-Des Moines sand strike at 1,451-70 ft. The well flowed 61 bbl. of oil per day on ¼-in. choke from 17 ft. of the pay. The shallow depth should set off a development play in this area.

Shell's Little discovery in the Enos area is a Pennsylvanian-Deese producer at 2,803-53 ft. Recovery on test of the zone was 2,450 ft. of oil. This one should also set off a shallow play near the Red River.

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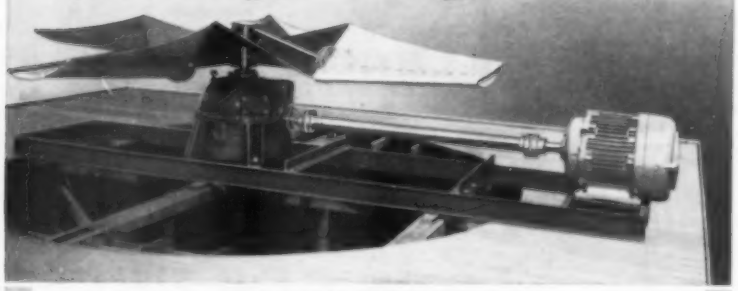

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Fifth well flows in deep Knox area

AN IMPORTANT and prolific north extension to the deep Ordovician field in the Knox area of Grady County, southwestern Oklahoma, flowed 28 M.M.c.f. of gas per day and 3,416 bbl. of condensate on calculated open flow.

The well is British-American Oil Producing Co.'s 1 Teter in C SW NE 18-3n-5w, 1 mile north of other deep wells in this ultra-deep producing area.

Production is from open hole in the second and third Bromide sands at 15,139-15,710 ft. The operator is readying location for the 1 Bell, another north extension try in SE SE NW SW 7-3n-5w.

The deep field now has five producers, all of which are producing below the 15,000-ft. mark. (See The Oil and Gas Journal, p. 166, April 14, 1958).

Williston symposium

THE SECOND International Williston basin symposium will be held in Regina, Saskatchewan, on April 23-25.

It will be jointly sponsored by the Saskatchewan Geological Society and the North Dakota Geological Society.

Final registration is expected to be 450. Registration opens at 1 p.m. April 22 at the Hotel Saskatchewan.

A total of 23 geological papers will be presented by a prominent group of geological experts. Among the topics to be covered by the papers are specific regional studies and six fields. The regional studies include the northern great plains paleogeology and the surface structure in southern Saskatchewan. The fields to be specifically studied are: Newburg and Rocky Ridge in North Dakota; Frobisher, Steelman and Dollard in Saskatchewan; and Outlook in Montana.

The symposium opens on Wednesday morning April 23 with an address by J. H. Brockelbank, minister of mineral resources of the Saskatchewan Government.

A welcome will also be given by Don Sarber, Sinclair, president of the North Dakota Geological Society in Bismarck. President of the Saskatchewan Society is Dr. E. E. Cummings, Tidewater.

The keynote speech will be given by Dr. Theo A. Link, Cree Oil Co., Calgary, past president of the American Association of Petroleum Geologists.

MOUNT AUBURN Consolidated field in Christian County, Illinois, is one of the most active areas in the Tristate basin this spring.

Action jumps in Mount Auburn pool

ONE OF the Illinois basin's most active areas this spring is south of Mount Auburn in Christian County. Focal point of a busy drilling campaign is Mount Auburn Consolidated pool.

The best well completed yet in this play is Reeter & Hirstein 1 Alta Ellis, SE SE SW 24-15n-2w. It flowed 400 bbl. of oil per day on ¼-in. choke from Silurian at 1,910-20 ft. after acid treatment.

Another good well is C. B. Mansfield 1 Frank Davis, SE NE NW 25-15n-2w. It flowed 180 bbl. per day through choke following acid treatment from the Silurian at 1,906-12 ft.

Reeter & Hirstein's 1 Stowers, SW NE NE 26-15n-2w, flowed 20 bbl. of oil per hour on ¾-in. choke from Silurian at 1,910-20 ft.

A wildcat in the area, James D. Jordan 1 H. L. Morgret, NE NE SE 35-15n-2w, is ready to test the Silurian at 1,944-46 ft.

Noble presenting greener pastures

ILLINOIS has a promising new producing area. Location is 4 miles south of Noble in Richland County.

Perry Fulk found oil at the 1 J. Gibson in SE NW NE 33-3n-9e, and at the 2 J. Gibson in NW SW NE 33-3n-9e. The first well is being put on pump to test after being swabbed for 25 bbl. of oil per hour in the Rosiclare at 3,037-42 ft. and the McClosky at 3,067-76 ft.

The No. 2 Gibson well swabbed 34 bbl. of oil per hour from the same pay zones. Another well is this new area in the 1 Bell, SW SE SE 28-3n-9e. Casing has been set at this one after drill-stem tests in the McClosky got 285 ft. of oil, 240 ft. of oil-mixed mud, and 40 ft. of mud.

Illinois Completions Plummet in March

ILLINOIS oil well completions dropped to the lowest level in 5 years in March, according to the Geological Survey, Division of the Department of Registration and Education.

There were 125 wells completed in March, as compared with 189 in March 1957. Both represent 5-week periods. Although March is usually the slowest drilling month due to unfavorable road and weather conditions, these figures suggest the low drilling rate to be the result of additional factors. The 125 wells completed in March included 51 oil wells.

No new pools were discovered in March, but there was one extension to each of the following pools: Mount Auburn Consolidated in Christian County, Gila in Jasper County, Raleigh South in Saline County, and New Harmony Consolidated in Wabash County. The estimated production for March is 7,136,000 bbl. of oil.

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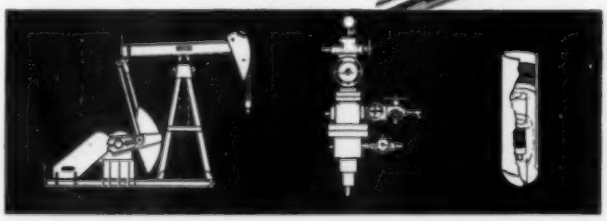

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Record rains wash out some California operations

SPRING RAINS, which reached record proportions, washed out a number of wildcat operations in California. Impassable roads to remote areas brought testing and completion of some of the more interesting efforts to a virtual halt.

Hit hard by the torrential rains was Doyle B. Barnes' discovery well at Orchard Ranch 1½ miles west of the Pyramid Hills field in Kings County. Operations have stopped and the rig was stranded in deep mud while being moved off the site. Installation of tankage has also been impossible due to mud.

The well itself, 25 Pearson-Sibert-Philadelphia - Orchard, flowed 40°-gravity oil from an Avenal sand pool at 2,727-37 ft. at a rate of 150 bbl. daily through a 5/64-in. choke.

Elsewhere in the state, particularly in northern California, rains halted operations on interesting wildcats in the Los Medanos area of Contra Costa County, in the Afton region of Glenn County, and on several wildcats in the coastal San Mateo County.

WILDCAT OPERATION in Ventura County was blocked by rains, but some action took place in the areas indicated.

Tidewater Oil Co. was hard hit by a huge landslide in the Ventura Avenue field of Ventura County. Damage to existing wells, a gasoline plant, pipelines and other facilities was estimated at close to $100,000. A pumper and his companion narrowly escaped death when their pickup truck was swallowed up in a huge crevass that opened up as they were driving through the field. They managed to scramble up the sides to safety before more slides hit.

The drilling reports were studded with accounts of wildcats "idle due to rain" or "roads washed out."

Wildcat drilling in Ventura County is highlighted by these operations:

... **Standard Oil Co.** of California, Western Operations, Inc., was drilling below 6,395 ft. on N. W. Arundell in the hills above the deep Fillmore field. This play is associated with the San Cayetano fault found on the north side of the Santa Clara Valley which is similar in circumstance to the major Oakridge fault on the south side. Both are steeply overturned faults. This is a farmout from General Petroleum Corp. and is about 2¾ miles northeast of the nearest Fillmore field producer. It has a projected total depth of 11,000 ft.

... **In the Oxnard field,** Max Pray was fishing for stuck drill pipe at 6,301 ft. in 2 Max Pray-Donlon, an extension test a little more than ¼ mile west of its recent Sespe pool discovery 1 mile south of the nearest Oxnard field well. The discovery well was completed in a Sespe formation of Oligocene age and appears to correlate with the McInnes zone of the main field.

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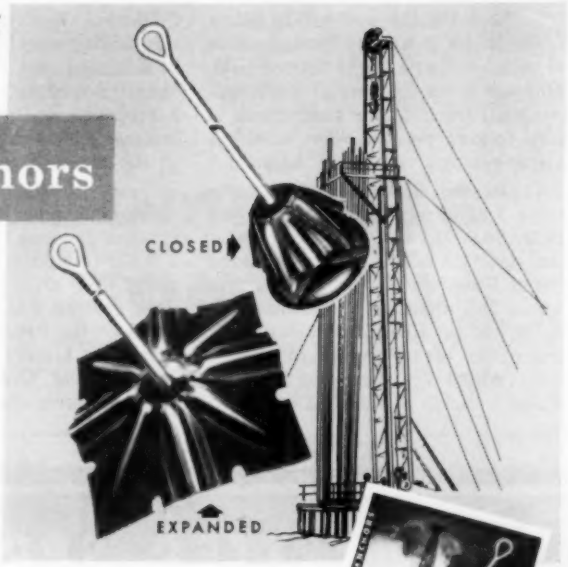
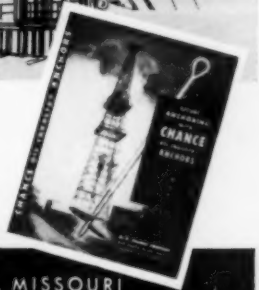


Load evenly distributed over a wide area due to square pyramid shape.



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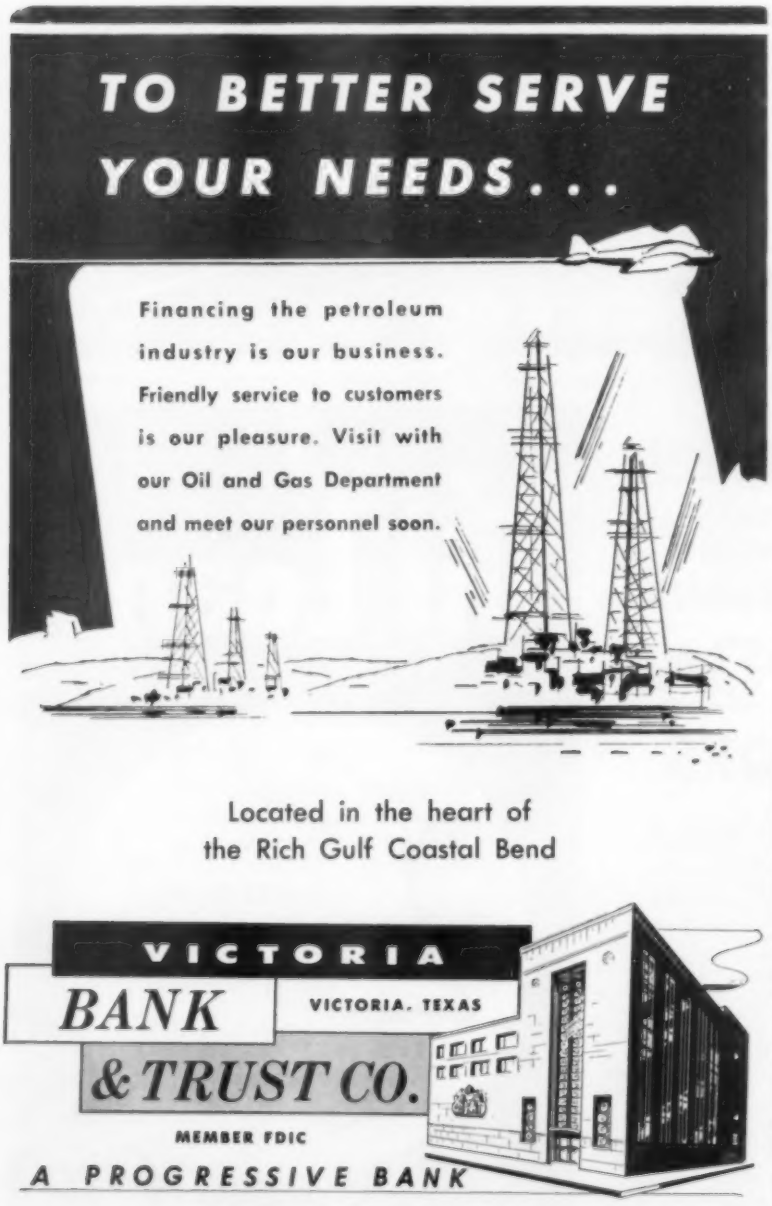
... **Shell Oil Co.** was drilling below 7,306 ft. on a wildcat located about ½ mile southwest of the Saticoy field. This test is on the general southwest-northeast trend of the field which in turn follows the Oakridge fault, the major geologic feature of the area.

... **In the** Springville dome area some 3 miles northeast of the Oxnard field, Shell Oil Co. recently threw in the towel at 8,200 ft. on a wildcat there. Elsewhere in the Oxnard field area, The Texas Co. abandoned at 8,780 ft. a southeasterly extension test of the Max Pray discovery.

... **About** 2½ miles north of the Oxnard field, Standard Oil Co. of California, Western Operations, Inc., was drilling ahead below 8,889 ft. on 2 Borchard, the first offset test to Standard-Western's El Rio field discovery of last January. This Standard test is located about ¼ mile south of the discovery well.

California highlights . . . The Texas Co. was plugging to abandon 1 Timm, a 5,523-ft. wildcat in the south Pleasant Creek area of Solano County. This gas test fell about 5 miles due south of the Pleasant Creek gas field and some 8 miles southwest of Winters gas field. Union Oil Co. plugged back its latest attempt in the Saugus area, 1 Benelli, to 760 ft. after running an electric log and sidewall sample to 2,923 ft., total depth. Cann & Wallis, operators, reported good gas and oil shows in their 2,457-ft. wildcat in the Half Moon Bay area of San Mateo County. This region was explored for commercial oil possibilities as far back as 1867 because of seepages of high-gravity oil from Pliocene and Miocene sediments and showings in shallow water wells. Humble Oil & Refining Co. abandoned at 2,918 ft. a wildcat test near Capitan some 4 miles west of the old Capitan oil field.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Operators quit at Arizona's wildcat

THE WALKER CREEK wildcat in Apache County, northeastern Arizona, has been abandoned.

Gulf Oil Corp. 1 Navajo, C SW SE 28-41n-26e, 6 miles south of the Utah line on the edge of the Paradox basin, went to total depth of 6,738 ft.

This well is 10 miles south of North Boundary Butte field. No other data was released.

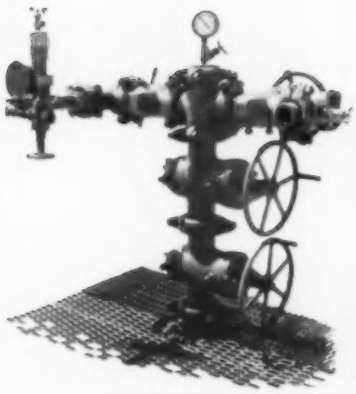
Dakota, Newcastle pay in Wyoming

TWO DISCOVERIES were reported in Weston County, Wyoming, by Tennessee Gas Transmission Co.

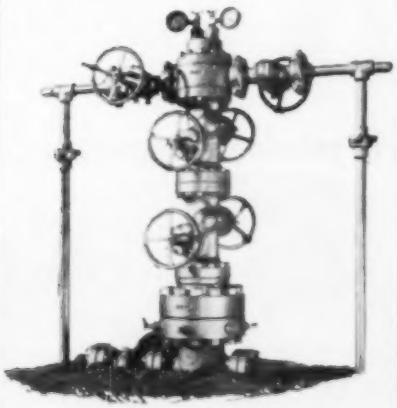
The first Weston County well, the TGT 1 Lottie B. Long-Davis, was completed from the Dakota sand at a depth of 6,878 ft. for a pumping potential of 99 bbl. of oil per day and no water. The well is about 5 miles southwest of Fiddler Creek field, but the nearest production from the Dakota is in Donkey Creek field 35 miles to the northwest.

The other discovery in Weston County is the TGT 1 State "A," with production indicated from the Newcastle sand. A drill-stem test at 7,105-31 ft. resulted in 200 ft. of oil, 175 ft. of oil and gas-cut mud and no water. The well is approximately 1 mile west of Fiddler Creek field.

The third well will be drilled in Campbell County, Wyoming, as an offset to a recent indicated discovery, the Davis 1 Federal, which flowed 20 bbl. per hour from the Parkman sand. The area is about 6 miles north of Dead Horse Creek field. The company's offset well will be about 2 miles west of the TGT 1 Cole, which was drilled in 1956 and was the first indication of production in the area.



This Well Control System is now in service in West Texas.



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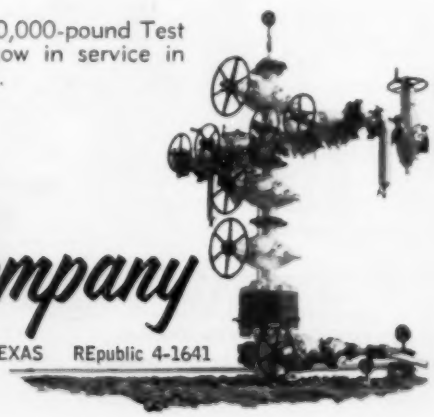
Simplification of design gives maximum flexibility and positive, efficient handling of every well control problem. Parts are creatively engineered to reduce the areas subject to pressure, provide more strength with less weight. Manufacturing is done by thoroughly trained, experienced men in the most modern, best equipped facilities available. Tooling, assembling and testing are backed by 35 years of consistent pioneering in the development of the best in well manifolds. Altogether, it means **complete** control at any depth or pressure.

Gray Well Control Systems . . . **complete control with complete safety.**

For additional information see the Gray Tool Company Catalog in Composite Catalog or write, wire or phone

This 30,000-pound Test System now in service in Louisiana.



GRAY *Tool Company*

P. O. BOX 2291 HOUSTON 1, TEXAS REpublic 4-1641

G 5802

Remote Rio Grande test may stretch Edwards play

DRILLING is getting under way on the second prospect in Southwest Texas' Webb County to be explored for a possible long-southwestward extension of the deep Edwards trend of fields.

It is in a remote area in the northwestern part of the county where Hamman Oil & Refining Co., of Houston, has gone into an old hole which Amerada Petroleum Co. drilled (in 1949) to 11,679 ft. and abandoned. Hamman proposes to deepen the hole to 15,000 ft. with Edwards lime expected below 13,000 ft.

Location of the wildcat, 1 Rosa Vela de Benavides, is about 20 miles northwest of the large Pescadito salt dome, the country's other prospect on which Edwards lime potentialities are being explored.

It is more than 20 miles southwest of the present most southwesterly field on the deep Edwards trend extending in a southwesterly northeasterly direction through LaSalle, McMullen, and Atascosa counties. Present most southwesterly field is at Stuart City, in the southwestern corner of LaSalle County.

SITE of Hamman's remote deep Edwards wildcat in wide-open expanse of Southwest Texas' northwestern Webb County.

At Pescadito, 15 miles east of Laredo, Ginther, Warren & Ginther, and their associates, are on their second Edwards exploratory attempt. In it they are trying to recover stuck drillpipe following a high-pressure gas blowout which occurred while drilling below 14,000 ft. in what is believed to be Georgetown lime. Hole is projected to 16,500 ft.

Poor Fishing Results Close Kentucky Well

ON CARD CREEK in Pike County, United Fuel Gas Co. is shut down at their 8503 John S. Kline, a wildcat test for the area.

Operator has been trying to drill past tools after an unsuccessful fishing job.

Formation tops encountered to date include: Ravencliff 1,795 ft., Big Lime 2,460 ft., and Berea 3,483 ft. A gas show of 21 M.c.f. was had in the Mississippian Big Lime section at 2,837 ft.

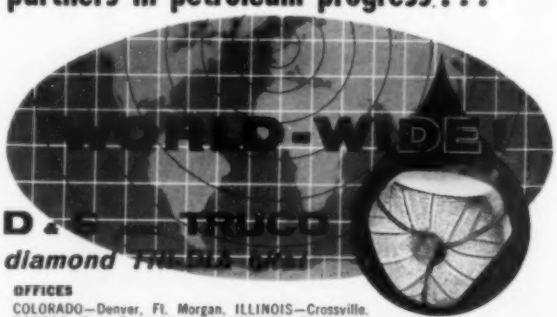
Michigan Activity Looms, But Drillers Remain Cautious

An active drilling play is anticipated in Barton Township, Newaygo County, but it is likely to follow a cautious path until one or more additional oil wells have been drilled.

John B. Cutter spudded 1 State, southeast offset to his 2 Cory, SE SE NE 16-16n-11w, the discovery.

No. 2 Cory is pumping and flowing an average of 65 bbl. oil per day with total fluid lift of 150 bbl. from Traverse pay at 3,103-07 ft.

partners in petroleum progress...



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Drilling & Service

While water is fairly common to many Michigan Traverse reef pools, the ratio on the Barton discovery has operators concerned.

FOR THE FIRST TIME, a rig has been pulled from western Canada to Prince Edward Island for a drilling job, complete with crew.

Big western rig drills in Maritimes

AFTER a 3,000-mile trek from western Canada behind a giant rig and drilling equipment, an Imperial Oil, Ltd., drill crew on March 3 spudded in the first wildcat well in 13 years on Prince Edward Island in the Gulf of St. Lawrence.

Company authorities say the well, which passed the 4,500-ft. mark before the end of March, will be taken down 8,000 or 9,000 ft.

Neither oil nor natural gas has ever been found in this province, but gravity meter and seismic exploration has indicated underlying rock formations favorable to the accumulation of oil. Officials point out that these investigations are by no means conclusive and that Imperial Wellington No. 1, as the well is called, may very well end as a dry hole.

The Prince Edward Island venture marks the first time both a crew and rig have been transplanted from western Canada to the Maritimes. The rotary rig was dismantled at Red Deer in Alberta's Joffre field and loaded onto 24 freight cars. Equipment was reassembled at the drill site on a farm near Wellington, 15 miles west of the town of Summerside.

Imperial's producing officials estimate the well's costs at about $200,000, and point out that the figure represents around 15% of 1 day's average expenditure by the oil industry for exploration and development in Canada last year.

Only once before in Prince Edward Island history has an exploratory well been drilled. In 1945, the well was abandoned after bottoming at 14,700 ft. Until 1957, this was the deepest test hole ever drilled in Canada.

Kerr-McGee Moves Onto Canadian Scene

A GAS DISCOVERY on a 24,000-acre block 90 miles north of Calgary marks the entry of Kerr-McGee Oil Industries, Inc., Oklahoma City, into the production of oil and gas in Canada.

The first well drilled by Kerr-McGee in Canada is 11-20-39-1 Sylvan Lake in C SE NW 20-39-1w5, flowing gas from two zones with a total net porosity of 57 ft.

The well was perforated and completed in the Pekisko member of the Mississippian, at intervals of 6,589-

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. . . because moisture is locked out
NEW
R&M
"All Weather 40"
OIL COUNTRY MOTORS
Here's how R&M "weatherizes" motors! It undercoats steel parts with a rust-resistant . . . treats iron parts with anti-corrosion primer . . . varnish-dips and bakes windings twice. Terminal box is gasketed . . . power leads sealed at shell. Baffles lock out wind-driven rain. Rodent screens are factory-installed. Yet these dependable R&M 40° heat rise motors cost no extra! Write today for Bulletin 520-OG!
ROBBINS & MYERS, INC.
MOTOR DIVISION • SPRINGFIELD, OHIO

6,609 ft. and 6,670-90 ft. The upper portion has 31 ft. of MicroLog porosity; the lower portion 26 ft.

Absolute open flow is estimated at 16 M.M.c.f. of gas per day. On the first drill-stem test during the drilling process the well was flowed 60 minutes from the 6,601-44-ft. interval, gas to the surface in 8 minutes, flowing at the rate of 2.74 M.M.c.f. per day. On the second drill-stem test, the well flowed at the rate of 4.07 M.M.c.f. per day through a 10/64-in. choke, after 45 minutes testing from 6,668-6,758 ft., gas to the surface in 2 minutes.

Kerr-McGee is earning a 60 per cent interest in the block, under a farmout of the gas license from Tennessee Gas Transmission Co.

Alabama Completion Extends Citronelle Field

Completion of a water-free oil well 1½ miles southeast of Alabama's Lower Cretaceous Citronelle field, in Mobile County, stretches the field's productive area a distance of nearly 6 miles from its present most northerly limits.

The new extension is by Magnolia Petroleum Co. at its 1-A School Land, in Cedar Creek State Park. It is productive from a series of thin sand streaks in the Rodessa section. Pay is perforated in 7 intervals totaling 111 ft. of sand from 10,875 to 11,153 ft.

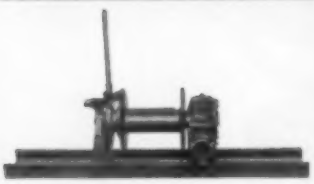
Production, by Kobe pump, is at the rate of 116 bbl. of 44°-gravity oil per day. The well was drilled to 11,800 ft. in the Pine Island zone.

If You Own a Truck — You Need a BRADEN Winch!

Many truck owners say the most useful piece of equipment they own is a winch. That's because a winch saves hundreds of man-hours a year by taking over those handling jobs that are difficult to do without mechanical help.

Pictured below are two of the smaller BRADEN winches that have hundreds of uses. They are designed for smaller trucks or tractors . . . are easy to operate and made to last.

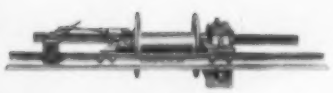
See your nearest BRADEN dealer for information on the entire line of BRADEN Truck Winches.



MS3-7 and MS3-10

Capacity: 8000 pounds

They have many features that were formerly found only on much larger winches. They are easy to install . . . easy to operate . . . and easy to maintain.



MSU3-10

Capacity: 8000 pounds

Underslung model for under body mounting behind cab, and the "F" series for front end mounting. Ideal for ½ and 1 ton trucks with tanks, dump bodies or other equipment.

Write for Catalog

BRADEN WINCH COMPANY

P.O. Box 547, Broken Arrow, Oklahoma

BRADEN Winches

In service around the world

Successful Wildcats

CALIFORNIA

Kings County: Doyle B. Barnes 25 Pearson-Siebert-Philadelphia-Orchard, NW SW 30-24s-18e, 150 BOPD, 38?-40° gravity, 5/64-in. choke, perfs. 2,727-2,737 ft., TD 4,312 ft. (New Avenal sand field discovery 1½ miles west of Pyramid Hills field production.)

MICHIGAN

Newaygo County: John B. Cutter 2 Cory, SE SE SE 16-16n-11w, Barton Township, 6 miles northwest of Paris oil field, 65 bbl. oil after 500-gal. acid treatment. Elevation 1,100, Traverse lime, 3,076, Traverse chert 3,086, pay 3,103-07, TD 3,110 ft. (new oil pool).

SASKATCHEWAN

Mobil-Woodley-Sinclair 11-15 Beverly, LSD 11, 15-15-16w3. Cantuar sand oil discovery. TD 3,548 ft.

ALBERTA

Cities Service-French Petroleum 6-20 Greencourt, LSD 6, 20-58-9w5. Nordegg oil discovery. TD 5,300 ft.

Kerr-McGee 11-20 Sylvan Lake, LSD 11, 20-39-1w5. Mississippian gas discovery. TD 6,758 ft.

BRITISH COLUMBIA

White-Lloyd-Fargo 4 Halfway, 11-35-86-25w6. Triassic gas discovery. TD 3,718 ft.

SOUTH LOUISIANA

Cameron Parish: Austral Oil Exploration Co., Inc., 1 North American, 17-14s-6w. IP 1,942 M.c.f. and 17.77 BOPD, 5/32-in., 47.9°, TP 3,465 psi., perforations 10,015-23 ft. TD 10,851 ft. (Second well and new pay in East Chenier Perdue field.)

Iberia Parish: California Co. 4 Williams, Inc., 33-12-11e. IP 124 BOPD, ¼-in., 52.2°, GLR 50 M.c.f. per barrel, TP 4,500 psi., perforations 12,042-60 ft. TD 12,800 ft. (New pay in North Bayou Long field.)

Plaquemines Parish: Phillips Petroleum Co. 1 State Lease 3120 (Adams "E"), 19-20s-28e. IP 198 BOPD, ⅛-in., 41.2°, GOR 914 cu. ft. per barrel, TP 1,775 psi., perforations 10,090-10,108 ft. TD 13,010 ft. (New-field discovery—Adams Bay area.)

Phillips Petroleum Co. 1 State Lease 3091 (Adams "D"). IP 51 BOPD (net), 5% water, ¼-in., 39°, TP 100 psi., perforations 11,509-12 ft. TD 13,008 ft. (New-field discovery.)

Terrebonne Parish: Southern Natural Gas Co. 1 Continental Land & Fur, 10-18s-12e (2½ miles northwest of Deer Island field). IP 304 BOPD, 7/64-in., 34.1°, GOR 1,655 cu. ft. per barrel, TP 4,750 psi., perforations 11,760-64 ft. TD 12,309 ft. (New-field discovery.)

Vermilion Parish: Sinclair Oil & Gas Co. 1 Picard, 2-11s-2e. IP 2,903 M.c.f.

This valve is the Mission 2-inch figure 400 valve. See Mission catalog for complete listing of sizes and pressure ratings

New as tomorrow

MISSION'S LINE OF AUTOMATIC-LUBRICATED PLUG VALVES

HIGHER PERFORMANCE — LOWER COST! Just look at this cutaway of one of the new Mission Plug Valves. Here is advanced engineering that prevents valve troubles before they start.

Of course, this valve features the Mission split cylindrical plug with Automatic Lubrication and circular grease grooves around each port arranged so they are not washed by line fluid when the valve is operated.

When you combine all these features with the non-galling qualities of the Missionized plug halves, you get a basic valve mechanism that is as trouble-free as modern science can develop.

But that is not the whole story. Notice the Teflon combination thrust bearing and stem seal backed up by an "O"-Ring. This arrangement provides easy turning and positive sealing.

At the bottom, Mission uses a unique metal-to-metal seal that does not depend on studs or gaskets.

With minimum care, Mission valves last indefinitely. They are also compact to fit into complex manifolds, and they are low in overall cost. They are offered in nearly all sizes and pressure ratings for production, cycling, injection, and certain refinery applications. For more information, contact your supply store, your well head manufacturer, or your Mission representative. The quicker you standardize on Mission Valves, the lower your overall valve costs will be.

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Thousands of grueling hours on tough jobs like salt water disposal, and this HD-11 is still going strong.

"Brother, that takes a good *crawler*—and the HD-11 sure measures up!" says M. F. Machen, Texas oil field contractor.

M. F. Machen
Midland, Texas

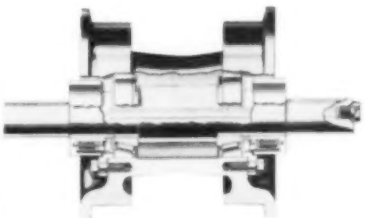
HD-11
94 belt hp
24,600 lb
(approx. as shown)

HD-11 cleans up shale pit and reservoir. Operator J.W.Thompson is "mighty pleased" with his machine.

Convinced by his first—now he owns four

It didn't take Mr. Machen long to prove the profit-making advantages of Allis-Chalmers machines. He bought his first three years ago—now owns three tractors and a motor grader.

Working his tractors in mud and brine, digging pits, cleaning up, building access roads, this busy contractor knows he can depend on Allis-Chalmers seals to keep dirt and water out of truck wheels and rollers, keep



costly maintenance to a minimum. 1,000-hour lubrication intervals for everything below track level means extra production time every day—hundreds of hours every year!

Ask your dealer to demonstrate an Allis-Chalmers construction machine on your job. See for yourself why more and more successful contractors are building their fleets with Allis-Chalmers—for *proved profitable performance.*

ALLIS-CHALMERS
CONSTRUCTION MACHINERY DIVISION
MILWAUKEE 1, WISCONSIN

Look ahead... *move ahead* ...and stay ahead with **ALLIS-CHALMERS**

daily and 68 BOPD, ⅛-in., 47.3°, TP 8,059 psi., perforations 12,158-66 ft. (New-field discovery.)

R. Mosbacher - Harry Hurt, Inc., and Union Oil Co. of California 1 Louisiana Furs, 14-14s-2e. IP 1,614 M.c.f. daily and 63 BOPD, ⅛-in., 50.1°, TP 4,650 psi., perforations 12,900-10 ft., and (dual completion) 1,400 M.c.f. daily and 30 BOPD, ⅛-in., TP 3,900 psi., perforations 12,416-34 ft. TD 13,020 ft. (New-field discovery—2½ miles south of Theal field.)

LOUISIANA OFFSHORE

Bay Marchand area: Phillips Petroleum Co. 3-B OCS-0223 (State Lease 1369), Block 5, Marchand area, Gulf of Mexico. IP 8,300 M.c.f. daily and 108 BOPD, 19/64-in., 52.9°, TP 3,950 psi., perforations 11,752-62 ft. TD 13,375 ft. (New pay in Bay Marchand Block 5 field.)

Eugene Island area: Humble Oil & Refining Co. 2-A OCS-0425, Block 63, Eugene Island area, Gulf of Mexico. IP 9,900 M.c.f. daily and 60 BOPD, 11/32-in., 44.8°, TP 5,300 psi., perforations 15,865-85 ft. TD 15,918 ft. (New pay in Eugene Island Block 77 field.)

South Timbalier area: Gulf Oil Corp. 2-A OCS-0457, Block 131 (bottom location), South Timbalier area, Gulf of Mexico (surface location in Block 130). IP 73 BOPD, ⅛-in., 37°, GOR 6,800 cu. ft. per barrel, TP 2,100 psi., perforations 6,704-14 ft. TD 7,667 ft. (New-field discovery.)

TEXAS GULF COAST

Brazoria County: Pan American Petroleum Co. 1-A Bernard River Land Development Co., Oliver Jones Sur. (1½ miles southwest of Sweeny and 1½ miles southeast of Old Ocean field). Absolute open-flow potential 34,500 M.c.f. daily, GLR 25.4 M.c.f. per barrel, 52°, shut-in TP 4,401 psi., perforations 11,340-50 ft. (Frio). TD 14,005 ft. (New-field discovery.)

Group Oil Co. 1 Turner Gray-Bank of Southwest Unit, S. F. Austin Sur. 9, A-25 (½ mile south of Bonney). IP 176.7 BOPD, 9/64-in., 38.5°, GOR 872 cu. ft. per barrel, TP 1,125 psi., perforations 7,851-55 ft. (Frio). TD 8,007 ft. (New pay in Bonney field.)

Chambers County: Meredith & Co. et al 1 J. H. Solem Unit 1, Lot 2, Block 69, J. M. Duran Sur. (4 miles north of Winnie). IP 125 BOPD, ⅛-in., 31.6°, TP 750 psi., perforations 6,120-28 ft. (Miocene). TD 8,927 ft. (New pay in North Winnie area.)

Sun Oil Co. 2 Sterling Estate, F. B. Sterling Sur., A-476 (4 miles southwest of Stowell). IP 175 BOPD, XX-35 choke, 34.6°, GOR 571 cu. ft. per barrel, TP 700 psi, perforations 8,291-97 ft. (Frio). TD 8,550 ft.(New pay in North Willow Slough field.)

DeWitt County: Western Natural Gas Co. 1 Thomas White, Thomas Lockhart Sur., A-26 (2.8 miles west of Thomaston). Absolute open-flow potential 11,200 M.c.f. daily, GLR 56.6 M.c.f. per barrel, 53.3°, shut-in TP 3,020 psi., perforations 8,404-20 ft. (Wilcox). TD 9,510 ft. (New reservoir in Annie Barre area.)

Hardin County: Oil Reserves Corp. 2-K Kirby Stephenson "B," James Stephenson Sur., A-444 (7 miles northeast of Votaw). IP 109.5 BOPD, 11/64-in., 38.5°, GOR 1,055 cu. ft. per barrel, TP 550 psi., pers. 8,407-19 ft. Wilcox). TD 8,949 ft. (New pay in Votaw field.)

Nueces County: L. A. Douglas 1-B Heuermann, Section 412, Charles Land Sur., A-854. IP 322 BOPD, ¼-in., 22.8°, GOR 59 cu. ft. per barrel, TP 570 psi., perforations 3,843-53 ft. (Catahoula), and (dual completion) 166 BOPD, 5/16-in., 24°, GOR 125 cu. ft. per barrel, TP 310 psi., perforations 3,808-18 ft. (Catahoula). TD 6,984 ft. (New pays in Violet field.)

Polk County: Oil Reserves Corp. 3 Kirby-Stephenson, James Stephenson Sur., A-523 (6 miles northeast of Votaw). Absolute open-flow potential 11,000 M.c.f., GLR 48.9 M.c.f. per barrel, 64.2°, shut-in TP 2,300 psi., perforations 6,463½-65½ ft. (Yegua). TD 10,200 ft. (New pay in Menard Creek field.)

SOUTHWEST TEXAS

Dimmit County: Texas Seaboard Oil Co. and C. C. Winn 1 Hagen, Lot 53, Section 165, Cross "S" Ranch Subd., Narciso Aguirre Grant. IPP 75.34 BOPD (net), 10% water, 39°, GOR 200 cu. ft. per barrel, perforations 4,526-38 ft. (San Miguel-FB-2-S sand). TD 4,552 ft. (New pay in North Elaine field.)

Duval County: Synura Oil Corp. 1-E Atlee Parr, Lot 55, Wheeler & Splane Subd., San Andres Grant, A-657 (7½ miles southeast of Benavides). Absolute open-flow potential 3,650 M.c.f. daily, GLR 15.35 M.c.f. per barrel, 56.4°, shut-in TP 2,504 psi., perforations 6,836-46 ft. (Yegua). TD 7,271 ft. (New field—2 miles southwest of Orcones field.)

Jim Wells County: Hamon & Coates 2-B Adams, Los Presenos de Arriba Grant, A-148. Absolute open-flow potential 5,600 M.c.f. daily, dry gas, shut-in TP 1,129 psi., perforations 3,070-73 ft. (Frio). TD 5,091 ft. (New pay in Al Smith field.)

A REPORT ON SOUTHERN NATURAL GAS SERVICE TO THE INDUSTRIAL SOUTHEAST IN

1957

GROSS REVENUES AND NET INCOME

of the Company during 1957 continued to climb to record levels. Net income was increased during the year despite substantially higher operating expenses. Dividends per share of common stock amounted to $2.00 as compared to $1.85 for the previous year.

SERVICES

supplied by the Company during 1957 reached a record number of industrial enterprises, gas distributing companies, pipelines and municipalities throughout the Industrial Southeast. The total volume of gas sold amounted to more than 316 billion cubic feet, the highest in the Company's history. The Company's management is continuing to plan for expansion of services to the Industrial Southeast and consequent benefits to consumers, stockholders and employes.

For a copy of our 1957 Annual Report, which contains detailed information about the Company's financial and service highlights during the year, write to Dep't. OG.

SOUTHERN NATURAL GAS COMPANY

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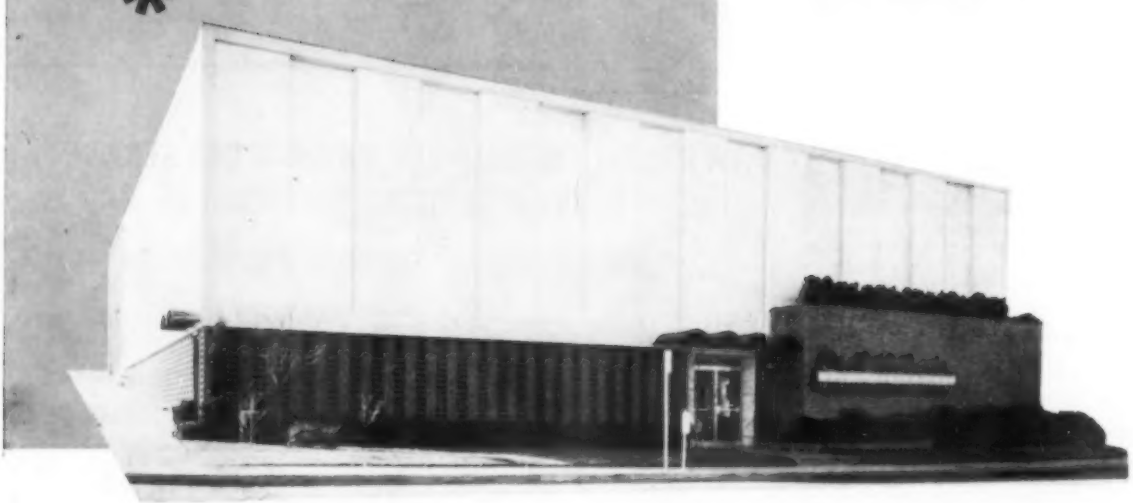

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1646 SOUTH BOULDER, TULSA

Jersey Taps Top Scientist

. . . as first president of new production research affiliate. Head of Carter lab moves up as Jersey changes setup.

STANDARD Oil Co. (N. J.) has picked one of the industry's top-notch scientists and petroleum research administrators to head the Jersey family's newest subsidiary.

As the first president of the newly formed Jersey Production Research Co., Dr. Carl O. Tongberg is No. 1 man at one of the best-equipped producing and exploration research centers in the world.

The new subsidiary was organized earlier this year to take over the Tulsa research labs of Carter Oil Co., another Jersey affiliate. Under the new setup the 400 staff members of the Tulsa lab transferred from the Carter staff to the new company.

Jersey Production will direct geological, geophysical, and production research activities for Jersey's domestic and foreign affiliates, working on problems from nearly every major oil-producing area in the world.

Long-time Jersey man . . . Tongberg is no newcomer to the Jersey family or to the Tulsa laboratories.

His fast-moving industry career began in 1937 while working on a college research project under contract with Standard Oil Development Co. (now Esso Research & Engineering Co.).

Promotions came quick for the brillant young scientist. He was named assistant director, then director of the company's research division. Early in 1954, he was appointed coordinator responsible for the entire work on research and development of petroleum products.

Later that year he became vice president, member of the executive committee, and a director of Esso Research at Linden, N. J. He and his family moved west to Tulsa in 1956 when he was named vice president and director of Carter Oil in charge of research.

DR. CARL O. TONGBERG
. . . from product to production research.

Budding scientist . . . His ability was first recognized years ago when he was a high-school teenager at Lynn, Mass. A teacher helped whet Tongberg's appetite for chemistry. His studies continued at Harvard University, and he received his bachelor's degree in 1927.

While an undergraduate, he worked as a lab assistant to James B. Conant, who later became Harvard's president and U. S. ambassador to West Germany. Conant, one eye cocked for gifted students, urged young Tongberg to do graduate work. (Conant is currently conducting a Carnegie study of U. S. high schools, with emphasis for improving courses of studies for gifted students.)

Tongberg took Conant's advice and won his master's degree at Harvard in 1930. Then he moved to Pennsylvania State College, where he was attracted by a grant for petroleum research. He became a research associate and later an assistant professor at Penn State, winding up with a doctorate in 1936. Soon after, his Jersey career began.

At first, he went into process development work. His first assignment was in fluid catalytic cracking. He also did some work on alkylation, isomerization, and lube additives.

His research studies and published papers have included a wide variety of subjects: Biochemistry, reactions under high pressures, extraction and distillation, research management, and solvent extraction.

But his interests are not limited to science and administration. His associates at Carter credit him with being a brilliant conversationalist, with a good sense of humor.

Golf and bowling are his favorite sporting activities. One day on a Canadian course, he made a hole in one to become a member of the elite Hole in One Club of Canada.

The Tongbergs have two sons. Richard is a high-school student in Tulsa. The eldest, Carl, is a student at Penn State.

Other appointees . . . The new company also named Max C. Sons and R. C. Curtis vice presidents for production and administration.

Sons has been with Carter lab as assistant chief since 1954. Curtis has been division manager of Carter's eastern division at Mattoon, Ill. Both men are also directors.

Other directors are M. A. Wright and Nelson Y. Ruth, both of Jersey Standard; O. C. Wheeler, International Petroleum Co., Ltd.; W. D. C. Mackenzie, Imperial Oil, Ltd.; Guillermo Zuloaga, Creole Petroleum Corp.; Carl G. Herrington, Carter; and Dr. Charles L. Fleming, Esso Research.

New appointees also include Dr. P. S. Williams, named senior research advisor. He had been chief of research at Carter lab since 1945. Dr. R. N. Meinert was named manager of administration. He was manager of production research coordination at Carter lab since 1956.

Personals

T. C. Coleman, tool pusher with Helmerich & Payne, Inc., has been transferred to Odessa, Tex., from Marlow, Okla.

Alvis Dumas has been promoted to district production foreman for Shell Oil Co. and transferred to Farmerville, La., from Jennings, La.

Arnold S. Bunte, geological engineer of the Denver National Bank, has retired. He will do consulting work in Santa Fe.

J. M. Helm has been promoted to area superintendent in Mount Carmel, Ill., for Tidewater Oil Co. He was formerly production foreman. Helm succeeds **J. A. Connett,** who has retired.

R. L. Zieve, geophysicist at Pan American Petroleum Corp.'s Bismarck, N. D., office, has been promoted to district geophysicist there.

Marvin Zeid has left Brazos Oil & Gas Co. in Houston to become a senior petroleum engineer with El Paso Natural Gas Co. there. Zeid was with Atlantic Refining Co. before joining Brazos.

Moody Heads API Mid-Continent Production Group

The Mid-Continent District of the API's division of production elected Wayne C. Moody (center), Sunray Mid-Continent Oil Co., Tulsa, as its new chairman at the district meeting in Oklahoma City. Shown with Moody (left to right) are Fred J. Neslage, West Pampa Repressuring Association, Pampa, vice-chairman for the Texas Panhandle; E. E. Young, Sohio Petroleum Co., Oklahoma City, outgoing chairman; D. L. Connelly, senior vice president of Warren Petroleum Corp., Houston, API vice president for production; and J. F. McDonald, Gulf Oil Corp., Oklahoma City, vice chairman for the Seminole-Oklahoma City area.

Vice chairmen elected are A. L. Dunn, Walter O'Bannon Co., Kansas; B. R. Ermey, Schlumberger Well Surveying Corp., Drumright-Perry area; Jack P. Denny, Phillips Petroleum Co., Southern Oklahoma; and W. B. Faught, Vickers Petroleum Co., Inc., Golden Trend area. Ralph W. O'Neill, Phillips Petroleum Co., Phillips, Tex., was elected secretary-treasurer.

A. J. Longley, petroleum engineer in Houston for Shell Oil Co., has been promoted to division mud engineer and transferred to Lake Charles, La.

Charles D. Moretti, instrumentation engineer with Gulf Oil Corp., has been transferred to the company's Philadelphia refinery from Pittsburgh.

William F. Styler, Jr., Tulsa, vice president and treasurer of Crescent Petroleum Corp., has been elected a director. The company's name was changed from Crescent Corp. to Crescent Petroleum at the annual meeting in Tulsa last week.

Frank A. Goerner, formerly vice president in charge of production for Pioneer Oil & Gas Co., has been named superintendent of production for domestic operations of San Jacinto Oil & Gas Co., division of San Jacinto Petroleum Corp. He succeeds **L. W. Goodrich,** who was recently named vice president of San Jacinto Venezolana, C.A. **Richard B. Hohlt,** formerly Houston exploration manager for **F. A. Callery,** independent, becomes chief geologist of San Jacinto. He succeeds **Roger W. Stoneburner,** who recently became a San Jacinto Oil & Gas director and vice president in charge of exploration.

Dennis E. Peterson, geophysicist, has been transferred to Midland, Tex., by Atlantic Refining Co. He was formerly at Winslow, Ariz., and Dickinson, N. D.

John A. Nugent, assistant exploration manager of International Petroleum (Colombia), Ltd., in Bogota, has been appointed technical adviser for International Petroleum Co., Ltd., in Caracas. He succeeds **Aden E. Stiles,** who is retiring. Nugent will take over his new post in August.

Frank C. Ploeger has been named division operating superintendent for Sun Oil Co.'s new eastern production division, Evansville, Ind. The new division is the result of consolidation of the central division, Evansville, and the Michigan production division, Toledo, Ohio. Ploeger was formerly operating superintendent for the central division. **Edward J. Combs** has been named chief geologist for eastern production division. **George D. Lindberg,** formerly Michigan division chief geologist, will transfer from Toledo to Mount Pleasant, Mich., as regional geologist. **Marvin L. Brown,** Michigan division operating superintendent, is retiring, as is **George W. Myers,** manager of the Michigan division.

Robert L. Sprague has been transferred by Shell Oil Co. from Lake Charles, La., where he was division exploitation engineer, to Houston, in the same capacity.

Sam Harlan, vice president of Cities Service Oil Co., has been appointed vice president and resident manager in Paris for Africa-Cities Service Petroleum Co., subsidiary of Cities Service Co. Africa-Cities Service holds, with French interests, exploratory concessions in Algeria.

W. Harry Mayne, Petty Geophysical Engineering Co., has been elected president of Geophysical Society of South Texas. **J. W. E. Edmonson,** consultant with P. E. Narvarte, is vice president, and **P. J. Rudolph,** Petty Geophysical, is secretary-treasurer. On the executive committee are Mayne, Edmonson, Rudolph, **W. Lee Moore,** Petty Geophysical, and **William R. Gray,** consultant.

William N. Roper, Los Angeles consultant, left for Iraq April 15 on assignment as an advisor to the development board of the Iraqi Government's Ministry of Development. He will be one of a three-man committee which will evaluate proposals for design and construction of a sulfur-recovery plant and gas-treating facilities. Roper was president of Western States Gasoline Corp. of California and Permian Oil Co. of Texas before becoming a consultant.

W. R. LOAR

William R. Loar, unitization engineer for Sunray Mid-Continent Oil Co., has been promoted to chief proration engineer. He succeeds **Burns H. Errebo,** who has joined Simms, Modrall, Seymour, Sperling & Roehl, Albuquerque law firm. Loar joined Sunray in 1951. He became unitization engineer in 1956. He will headquarter in Tulsa.

E. A. Pielemeir, vice president of United Geophysical Corp., has been elected chairman of the board. **B. W. Sorge,** also vice president, becomes president of the company. The appointments follow the retirement of **C. C. Lister,** president of United Geophysical since 1953. Lister will continue as a consultant to the company. Also, **R. G. Sohlberg,** vice president, has been named president of United ElectroDynamics, Inc., a subsidiary. Sohlberg will continue as vice president of United Geophysical.

Personals

H. BURROW

Harold Burrow, senior vice president of Tennessee Gas Transmission Co. since 1954, has been named first vice president and assistant to the president. TGT has also elected three senior vice presidents and four vice presidents. New senior vice presidents are **Joe J. King,** vice president, engineering development; **C. C. Johnson,** vice president and treasurer; and **W. W. Witmer,** vice president, gas supply. Elected vice presidents are **W. C. Braden, Jr.,** director of certificates; **L. W. A. Campbell,** chief engineer; **O. H. Simonds, Jr.,** director of sales; and **Stanley Ward,** director of taxes.

Allan B. Erwin, formerly with Gulf Oil Corp. in Evansville, Ind., has joined Apache Oil Corp., Tulsa, as petroleum engineer. Erwin, a graduate of the University of Tulsa, had been with Gulf for 5 years.

Frank D. Gorham, Jr., vice president and chief geologist of Pubco Petroleum Corp., Albuquerque, has been elected president of Rocky Mountain section of American Association of Petroleum Geologists. Other officers are **Harry L. Thomsen,** Shell Oil Co., Billings, Mont., vice president; **Leonard W. Heiny,** Continental Oil Co., Denver, secretary-treasurer; and **Joseph B. Headley, Jr.,** Southwood Exploration Co., Denver, state representative.

O. P. Puryear, assistant operations manager in The Texas Co.'s technical services division, research and technical department, has been named assistant manager, industrial, in the same division. Puryear succeeds **R. R. Thurston,** who has retired. Puryear's appointment set off a number of changes at Texaco's Beacon, N. Y., research center. **Louis E. Endsley, Jr.,** director of technical services at Beacon, will succeed Puryear as assistant manager of operations. Endsley will be succeeded by **J. Stanley McKeown,** supervisor of the field service department. **Albert D. Togna,** supervisor of the products testing department, becomes supervisor of the field service department. Togna will be replaced by **August Sellingsloh,** assistant supervisor of the analytical department. This position will be filled by **Joseph L. Furtnett,** staff chemist in technical services administration. **Neil H. Fick,** group leader in the products testing department, moves up to succeed Furtnett.

W. E. Stiles, vice president in charge of engineering and production for Buffalo Oil Co., and **Eddie J. Hudson,** petroleum engineer with Buffalo, have resigned to establish W. E. Stiles Engineering, Tulsa petroleum engineering consulting firm.

Robert C. Johnston has been named division manager at Eason Oil Co.'s newly opened Denver office.

Arnold E. Kelley has been appointed manager of the process engineering division of Union Oil Co.'s Brea, Calif., research center.

W. L. Phillips, director of the new plants and joint enterprises division of Phillips Petroleum Co.'s natural-gasoline department, has been named vice chairman of the operating committee. **H. D. Brookby,** manager of Phillips' foreign department, and **K. W. Rugh,** manager of advertising and public relations, have been appointed operating-committee members.

Glenn C. Ferguson, Ferguson & Bosworth, has been elected president of the San Joaquin Valley Oil Producers Association. He succeeds **Leonard R. Seaman,** Intex Oil Co. Other new officers are **Morton N. D'Evelyn,** MJM&M Oil Co., and **J. T. Woodward,** independent, vice presidents. New directors are **Max C. Eastman,** Reserve Oil & Gas Co.; **C. E. Williams,** Universal Consolidated Oil Co.; **Frank Hopper,** Hopper Machine Works, Inc.; and **E. A. Bender,** Bender Oil Operations. **C. O. Premo** was reelected secretary-treasurer of the association.

E. S. Doyle, production superintendent for Rimrock Tidelands, Inc., has been promoted to vice president in charge of production. **Earl G. Bateman,** president of E. G. Bateman Drilling Co. and Bateman Oil & Gas

E. S. DOYLE

E. G. BATEMAN

Co. in New Orleans, has been elected a director of Rimrock Tidelands. Bateman previously served as a director from January 1956 until June 1957. Doyle was with Trans-Tex Drilling Co. before its merger with Rimrock last year.

Ray Althouse has resigned as president of Royalite Oil Co., Ltd., Calgary. He had been president of the company for the past 3 years.

A. C. Mattei, president of Honolulu Oil Corp., has been elected chairman of the board. **L. A. Cranson,** executive vice president, has been elevated to president and chief executive officer. Mattei has been president since 1937. Cranson joined Honolulu in 1922 and has been executive vice president since 1947.

DEATHS

George Gerald Bauer, founder and editor of Producers Monthly and secretary of the Bradford District Pennsylvania Oil Producers Association, died April 13 in Bradford, Pa. Bauer collapsed while participating in a parade. With 121 others he had just been raised to the fourth degree of Knights of Columbus. Bauer had been Producers Association secretary since 1943.

Charles A. Breitung, Austin, Tex., consulting gas engineer, died of a heart attack April 10 in Israel, where he had gone for Easter services. Breitung, a prominent Catholic layman, was Oklahoma manager for Southwest Natural Gas Co. and an engineer with the Texas Railroad Commission before becoming a consultant.

Ray V. Hennen, 83, consulting geologist with the Benedum interests in Pittsburgh, died April 8 at his home in San Antonio, Tex., after a heart attack. Hennen was with Plymouth Oil Co., and Transcontinental Oil Co., before becoming a consultant.

H. J. Hirzel, Detroit independent, died April 6. He was 69.

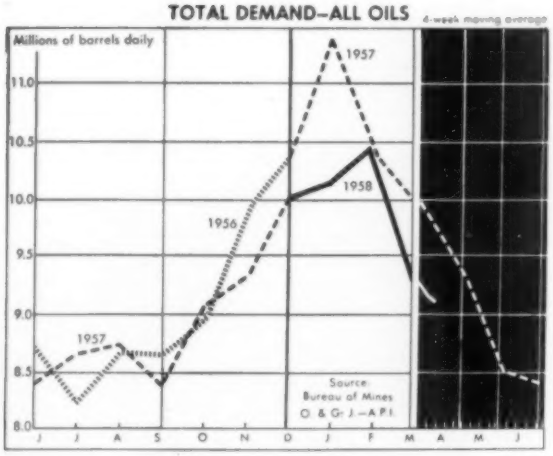
Thomas C. Buchanan, 62, former chairman of the Federal Power Commission, died April 10 at his home in Beaver, Pa. Buchanan served as a member of the Pennsylvania Public Utilities Commission prior to his appointment to the FPC in 1949. He resigned from the commission in 1953.

Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,191,775	DOWN	74,925	DOWN	1,273,298
Crude stocks	281,655,000	DOWN	3,984,000	UP	29,330,000
Completions	734	UP	19	DOWN	185
Refinery runs	7,571,000	UP	357,000	DOWN	328,000
Gasoline stocks	213,786,000	DOWN	968,000	UP	10,882,000
Kerosine stocks	17,406,000	UP	494,000	DOWN	2,417,000
Distillate stocks	73,727,000	DOWN	818,000	DOWN	429,000
Residual stocks	56,962,000	UP	2,212,000	UP	20,204,000
Four-product stocks	361,881,000	UP	920,000	UP	28,240,000
Total imports	1,588,000	UP	362,400	UP	202,600

TOTAL DEMAND—ALL OILS 4-week moving average



Unseasonal price changes catch marketers off base

THIS IS THE SEASON for stomach ulcers among refinery sales managers. It's not that the other seasons of the year are free of problems but that they crop up more often and at unexpected places each spring.

Take gasoline. Spot prices have been weak on the Gulf Coast for months. There were several periods when a few refiners had to sell some gasoline to make room for current production. Since all potential buyers knew that the material had to move, the final price in some cases was as much as 1.0 cent a gallon below formal postings. This condition existed throughout the winter.

Despite this general softness of the spot market on the Gulf Coast, refiners maintained their formal quotations on which contracts were based. In general, these contract prices are reflected in tank-wagon and service-station prices for the areas served with material produced on the Gulf Coast. This means that the average refiner's income last winter was not influenced too much by the low spot prices.

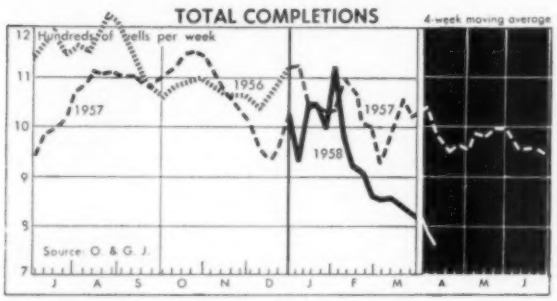
Then came April, the opening month of the gasoline season. Some supplier must have lowered his formal posted price in the first week of the month. Reports of lower quotations early the next week showed small reductions for high-octane premium but as much as 0.5 cent per gallon off on some of the lower grades of regular. The entire contract market was off about 0.25 cent a gallon just at the start of the motoring season.

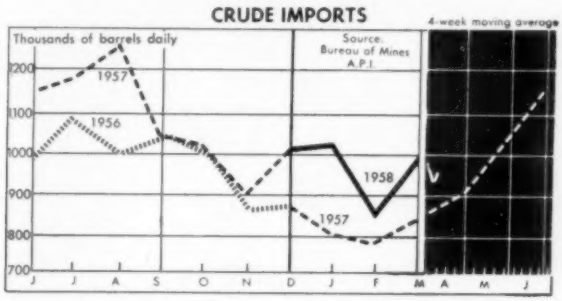
There is little chance that the price will move back up this season unless the gasoline-stock surplus can be wiped out before July. Chalk up one more ulcer.

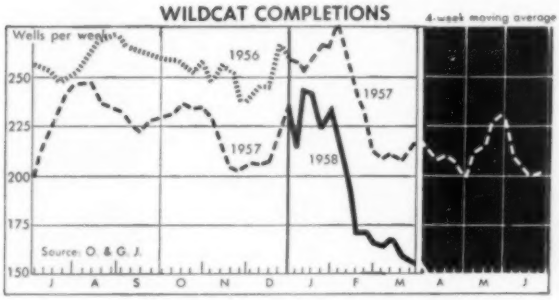
When comparing 1958 gasoline stocks with inventories last year, the refiner should keep in mind that stocks were too high last year. Companies reporting to the Texas Railroad Commission set the desirable stock level for April 1 at about 187,000,000 bbl. Last year the total was 207,000,000 bbl. and this year it was about 215,000,000 bbl.

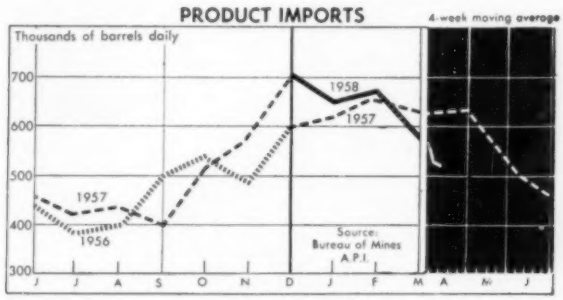
Promotion of summer-fill sales of distillate fuels will be another headache for the refinery sales manager this year. On the East Coast, this promotion normally consists of price guarantees and discounts. But, prices are at least 2 cents a gallon too low on the East Coast now. The current barge price for No. 2 fuel in the New York Harbor area is 8.85 cents a gallon or 2.8 cents lower than postings after the crude-price increase in January 1957. A discount of half a cent off the present price would mean the lowest quotation since 1950.

Residual-fuel markets are a little shaky, particularly on the East Coast. The surplus has been growing for sometime on the West Coast, and prices were cut, effective April 14. The reduction was 20 cents a barrel for residual and for 14°-gravity with smaller cuts up to 26°-gravity. Uncertainty in the New York market discourages shipments from West Coast to East Coast.





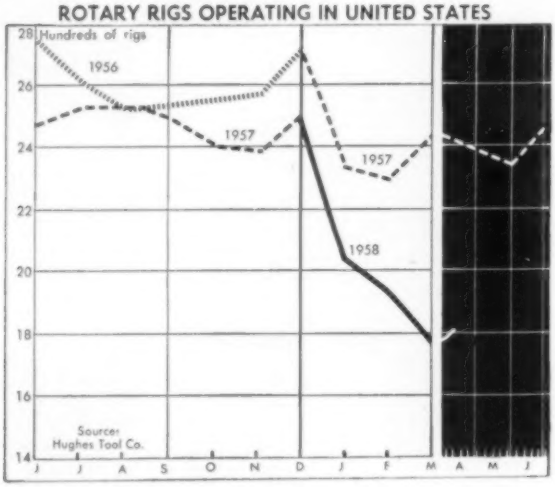




WEEKLY WELL COMPLETIONS . . . WEEK ENDED APRIL 12, 1958

	Total wells							Cumulative		Total wildcats					Cumulative	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1958	1957	Total	Crude	Cond.	Gas	Dry	1958	1957
Alabama	1	1	0	0	0	0	11,800	20	33	0	0	0	0	0	7	14
Arkansas	16	6	0	1	9	0	50,230	184	286	5	1	0	0	4	45	44
California	32	18	0	0	14	0	192,906	541	552	6	1	0	0	5	102	143
Colorado	8	1	0	0	7	0	41,638	206	276	3	0	0	0	3	107	187
Illinois	18	6	0	0	12	0	42,081	510	654	6	0	0	0	6	104	159
Indiana	9	1	0	0	8	0	11,955	181	182	5	0	0	0	5	65	40
Kansas	40	10	0	6	24	0	141,689	1,062	1,238	3	0	0	0	3	206	227
Kentucky	9	6	0	2	1	0	13,995	235	412	1	0	0	0	1	31	88
Louisiana	68	27	9	4	28	0	630,230	924	1,056	13	4	0	0	9	123	183
North	23	8	0	4	11	0	113,989	324	385	7	4	0	0	3	50	43
South	39	18	7	0	14	0	450,890	476	475	6	0	0	0	6	67	113
Offshore	6	1	2	0	3	0	65,351	124	196	0	0	0	0	0	6	27
Michigan	10	5	0	0	5	0	28,319	96	111	3	1	0	0	2	35	51
Mississippi	7	4	0	0	3	0	77,276	113	102	3	0	0	0	3	57	46
Montana	9	3	0	0	6	0	40,699	111	86	3	0	0	0	3	51	30
Nebraska	8	2	0	0	6	0	46,345	193	227	1	0	0	0	1	90	123
New Mexico	28	20	0	3	5	0	150,271	573	571	4	2	0	0	2	84	92
West	13	10	0	3	0	0	64,594	271	218	0	0	0	0	0	37	39
East	15	10	0	0	5	0	85,677	302	353	4	2	0	0	2	47	53
New York	10	5	0	0	0	5	13,500	155	131	0	0	0	0	0	13	0
North Dakota	6	6	0	0	0	0	49,346	115	88	1	1	0	0	0	39	34
Ohio	16	7	0	4	4	1	46,333	261	301	0	0	0	0	0	3	3
Oklahoma	98	51	1	6	36	4	275,444	1,921	1,927	8	2	1	1	4	250	219
Pennsylvania	9	1	0	5	3	0	63,384	32	307	2	1	0	0	1	6	29
Texas	304	163	9	13	113	6	1,354,332	5,144	6,145	62	7	3	2	50	1,074	1,658
Dist. 1	16	11	0	0	5	0	28,426	265	329	2	0	0	0	2	103	129
Dist. 2	19	4	3	2	10	0	123,614	183	198	4	0	0	0	4	48	84
Dist. 3	24	9	1	1	13	0	157,872	352	508	5	1	0	0	4	64	169
Dist. 4	29	11	1	2	15	0	144,675	341	395	7	1	1	0	5	102	148
East	16	11	2	0	3	0	57,131	357	356	5	0	2	0	3	100	110
Dist. 7-B	53	29	0	3	20	1	171,014	668	827	11	2	0	0	9	195	300
West	93	70	0	1	17	5	468,943	1,545	1,757	10	2	0	1	7	232	279
Dist. 9	43	15	0	3	25	0	137,216	1,063	1,388	17	1	0	1	15	200	408
Dist. 10	11	3	2	1	5	0	65,441	370	387	1	0	0	0	1	30	31
Utah	6	3	0	1	2	0	26,734	129	45	2	0	0	0	2	22	28
West Virginia	0	0	0	0	0	0	0	201	186	0	0	0	0	0	7	9
Wyoming	20	10	0	3	7	0	93,198	231	224	3	1	0	1	1	73	81
Nevada, Wash.	2	0	0	0	2	0	11,400	33	19	2	0	0	0	2	27	14
Total U. S.	**734**	356	19	48	295	16	3,413,078	13,171	15,160	**136**	21	4	4	107	2,621	3,502
Total prev. week	715	351	23	56	272	13	3,054,455	.....	.....	131	10	2	2	117	.....	.....
Cum. 1958	13,171	6,568	307	985	5,030	281	56,088,856	.....	.....	2,621	246	39	95	2,241	.....	.....
Western Canada	Not available							.....	789						.....	216

ROTARY RIGS OPERATING IN UNITED STATES

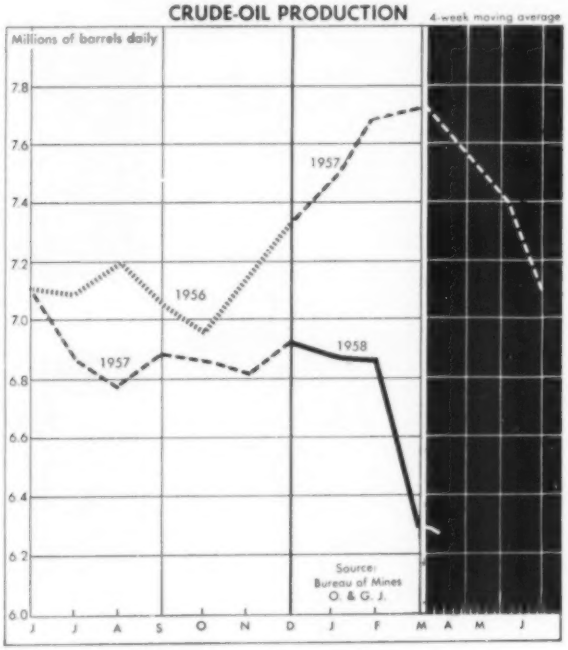


ACTIVE ROTARY RIGS*

	4-14-58	4-7-58	3-31-58	4-15-57
Alabama	5	4	4	12
Arkansas	15	17	18	19
Arizona				1
California	65	70	74	89
Colorado	25	27	24	37
Florida	1	1	1	3
Georgia				
Idaho				
Illinois	35	27	21	34
Indiana	6	7	3	6
Iowa	3	3	3	2
Kansas	109	93	79	154
Kentucky	3	2	1	3
Louisiana	300	304	303	420
North	38	29	27	59
South	211	223	224	266
Offshore	51	52	52	95
Maryland				1
Michigan	8	8	9	9
Missouri				
Montana	23	21	20	25
Mississippi	37	33	34	32
Nebraska	13	18	19	30
Nevada				
New Mexico	110	105	100	144
New York	1	1	1	1
North Dakota	37	35	39	23
Ohio				
Oklahoma	195	191	179	248
Oregon				1
Pennsylvania	11	10	12	13
South Dakota				1
Texas	727	730	740	1,075
Gulf Coast	177	157	178	225
Offshore	5	4	4	5
West	289	292	285	416
North	227	236	236	373
East	29	41	37	56
Tennessee				
Utah	32	36	37	32
Washington	2	2	2	
West Virginia	4	4	2	1
Wyoming	43	40	38	47
Virginia				
Total United States	1,810	1,789	1,763	2,463
Western Canada	84	115	158	108
Eastern Canada	1	2	2	
Grand total	1,895	1,906	1,923	2,571

*Hughes Tool Co.

CRUDE-OIL PRODUCTION

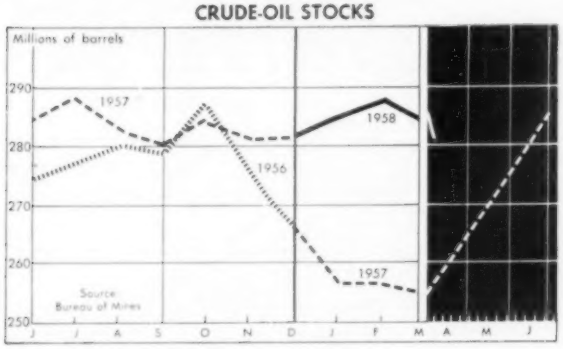


DAILY AVERAGE PRODUCTION FOR WEEK

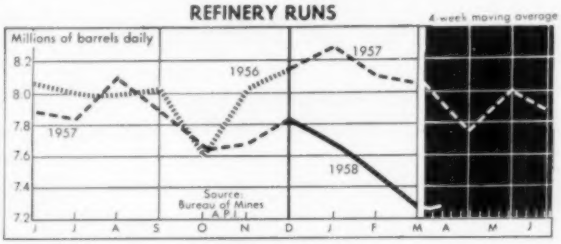
	April 12, 1958			April 5
	Crude oil	Lease condensate	Total	total
Alabama	15,950		15,950	15,925
Arkansas	81,300	200	81,500	83,900
California	875,200		875,200	879,400
Colorado	137,000		137,000	140,900
Eastern	49,000		49,000	47,600
Florida	1,275		1,275	1,225
Illinois	226,500		226,500	227,700
Indiana	32,900		32,900	33,000
Kansas	†299,700		†299,700	†309,050
Kentucky	44,600		44,600	38,600
Louisiana	738,100	87,675	825,775	822,575
North	113,100	2,800	115,900	115,800
South	625,000	84,875	709,875	706,775
Michigan	23,800		23,800	23,500
Mississippi	98,350	5,000	103,350	103,800
Montana	73,500		73,500	75,000
Nebraska	51,900		51,900	52,550
Nevada	100		100	100
New Mexico	251,525	6,800	258,325	261,225
North Dakota	24,350		24,350	30,150
Oklahoma	†524,000		†524,000	†545,600
Texas	2,157,500	63,900	2,221,400	2,255,900
Dist. 1	45,000	400	45,400	44,975
Dist. 2	89,000	9,100	98,100	99,800
Dist. 3	316,000	32,000	348,000	352,725
Dist. 4	157,500	7,600	165,100	166,600
Dist. 5	27,000	400	27,400	27,825
Dist. 6	96,000	7,400	103,400	105,125
East Texas field	117,000		117,000	120,425
Dist. 7-B	129,000	100	129,100	130,375
Dist. 7-C	110,000	3,550	113,550	115,700
Dist. 8	775,000	1,500	776,500	794,075
Dist. 9	189,000	1,200	190,200	190,625
Dist. 10	107,000	650	107,650	107,650
Utah	11,100		11,100	13,800
Wyoming	310,400		310,400	305,000
Others	‡150		‡150	‡200
Total U. S.	6,028,200	163,575	6,191,775	6,266,700
Change from prev. week, down			74,925	
Canada	†365,600		†365,600	†440,000
Total U. S. prod., Jan. 1-April 12				§675,095,050 bbl.
Same period last year (crude plus cond.)				*776,716,920 bbl.

*Includes 14,755,950 bbl. condensate. †Week ended previous Monday. ‡South Dakota. §Revised.

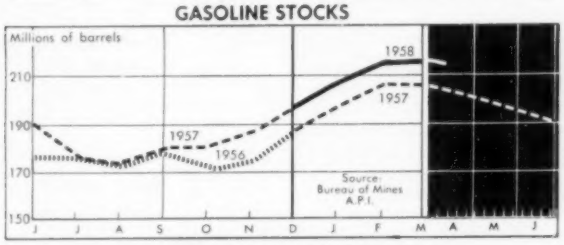
CRUDE-OIL STOCKS



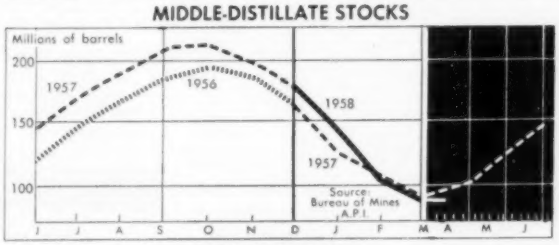
REFINERY RUNS



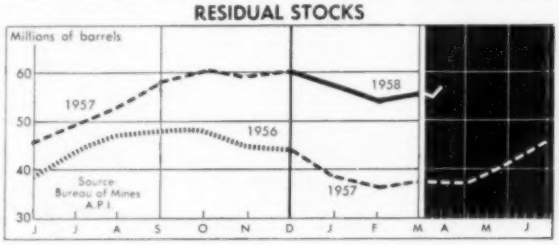
GASOLINE STOCKS



MIDDLE-DISTILLATE STOCKS



RESIDUAL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	4-5-58	3-29-58	4-6-57
Pennsylvania Grade	2,850	2,841	2,609
Other Appalachian	1,544	1,740	1,816
Illinois, Indiana, and Michigan	9,802	10,001	9,334
Nebraska and North Dakota	2,508	2,580	2,002
Kansas	9,576	9,847	9,013
Oklahoma	17,957	18,044	22,636
Arkansas	2,664	2,635	2,491
Louisiana	17,939	19,084	18,283
North	3,092	3,059	2,827
South	14,847	16,025	15,456
Mississippi, Alabama, and Florida	2,710	2,344	2,284
New Mexico	8,184	7,943	7,002
Texas	127,232	128,709	113,702
East Texas	8,351	8,123	10,869
West Texas	56,695	58,454	52,587
Texas Gulf	26,436	25,946	21,736
Other Texas	35,750	36,186	28,510
Wyoming	16,155	16,046	16,660
Other Rocky Mountain	7,016	7,230	5,919
California	38,937	38,676	25,622
Foreign	†16,581	17,919	12,952
Total	281,655	285,639	252,325

*Bureau of Mines. †Includes 4,734,000 bbl. in California.

API REFINERY REPORT—APRIL 11, 1958

(Thousands of barrels)

District—	Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.	Stocks‡—Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, April 1957—Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.
East Coast	1,268	476.7	44.0	324.9	184.4	47,518	7,108	21,568	11,343	1,187	483.8	34.0	315.7	212.5
Appalachian:														
District 1	91	37.9	3.0	24.6	7.7	5,362	524	1,628	628	96	39.7	5.5	19.2	7.2
District 2	109	57.1	7.0	25.0	10.6	2,678	309	735	504	106	51.7	5.0	15.2	13.5
Ind., Ill., Ky.	1,331	649.3	69.6	257.7	153.8	41,312	3,527	9,979	4,376	1,284	667.5	62.8	268.2	158.4
Minn., Wis., Dak.	108	51.6	6.9	29.4	10.6	6,700	422	3,393	567	87	41.2	5.2	23.2	7.7
Okla., Kans., Mo.	647	367.7	21.1	160.7	22.0	19,670	885	6,321	919	629	353.6	17.8	140.2	29.6
Inland Texas	252	188.9	6.1	44.6	19.7	8,066	295	1,208	2,041	251	190.6	7.5	50.9	20.5
Texas Gulf Coast	1,751	844.0	79.2	428.3	198.7	27,671	1,613	8,228	4,140	1,954	871.6	78.8	493.9	223.9
La. Gulf Coast	638	348.7	43.6	157.9	43.4	12,016	1,420	4,186	1,090	664	332.7	56.5	177.0	53.5
N. La. and Ark.	89	36.1	6.1	18.0	7.9	5,426	749	1,480	134	66	25.0	3.8	16.5	5.1
Rocky Mountain:														
New Mexico	26	12.6	1.0	5.0	3.0	424	19	138	87	28	15.3	0.4	5.4	2.4
Other Rocky Mt.	219	109.4	2.4	51.1	28.0	8,110	210	2,571	870	239	112.6	1.4	56.4	33.8
West Coast	1,042	508.1	0.1	147.1	345.6	28,833	325	12,292	30,263	1,149	501.8	5.3	182.7	363.8
Apr. 11, 1958	7,571	3,688.1	290.1	1,674.3	1,035.4	213,786	17,406	73,727	56,962	7,740	3,687.1	284.0	1,764.5	1,132.1
Apr. 4, 1958	7,214	3,589.1	314.7	1,643.7	969.3	214,754	16,912	74,545	54,750	.....	.....	.....	.....	.....
Apr. 12, 1957	7,899	3,760.3	304.9	1,778.7	1,118.3	202,904	19,823	74,156	36,758	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (89 octane)	11.00-11.50
Premium (98 octane)	13.75-14.25
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	9.75-10.25
Regular (92 octane)	10.00-10.50
Premium (97 octane)	11.375-11.75
Premium (98 octane)	11.875-12.50
California (rack) (Los Angeles):	
Regular (88 octane)	12.0
Premium (96 octane)	14.5
Premium (98 octane)	15.0
Caribbean area (cargoes):	
Regular (87 octane)	9.625
Premium (98 octane)	12.125

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
Grade 26-70	4.5
Breckenridge:	
Grade 26-70	4.0

*If 26-70 natural is considered as 100 per cent, prices for lower-vapor-pressure grades increase 2.5 per cent for each unit drop in Reid vapor pressure down to and including 16 lb. Prices for grades below 16 lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	9.25-9.50
Diesel oil (58 d.i. and above)	8.875-9.125
Distillate No. 1	8.875-9.125
Distillate No. 2	8.25-8.50
Gulf Coast (cargoes):	
Kerosine 41-43	8.50-8.75
Distillate No. 2	8.00-8.25
New York Harbor (barges):	
Kerosine 41-43	9.35
Distillate No. 2	8.85
Diesel fuel, 48-52 d.i.	9.45
Caribbean area (cargoes):	
Distillate No. 2	8.125

WAX (LB.)

Oklahoma (Group 3):	
132-135 A.m.p. (semi-refined) in tank cars	6.50
New York (export):	
126-130 A.m.p. crude-scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max 1% S)	$1.25-1.30
Gulf Coast (cargoes):	
Bunker C fuel	$2.25-2.40
New York Harbor (barges):	
Bunker C fuel	$2.65
Caribbean (cargoes):	
Bunker C	$2.25
California (rack):	
★ Bunker C fuel, Los Angeles	$2.45

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined, 0-10 p.p., 95 v.i.	23.0
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	20.5
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25 p.t.	26
200 vis. neutral (180° at 100°), 25 p.t.	24

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	★Signal Hill, Calif.	Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour)
14-14.9	$2.47	....	....	....	....
15-15.9	2.52	....	....	....	$1.81
16-16.9	2.58	....	....	....	1.86
17-17.9	2.63	....	....	....	1.91
18-18.9	2.69	....	....	....	1.96
19-19.9	2.74	....	....	....	2.01
20-20.9	2.80	$2.75	....	$2.62	2.06
21-21.9	2.85	2.77	....	2.64	2.11
22-22.9	2.91	2.79	....	2.66	2.16
23-23.9	2.96	2.81	$3.44	2.68	2.21
24-24.9	3.02	2.83	3.46	2.70	2.26
25-25.9	3.07	2.85	3.48	2.72	2.31
26-26.9	3.13	2.87	3.50	2.74	2.36
27-27.9	3.17	2.89	3.52	2.76	2.49
28-28.9	3.22	2.91	3.54	2.78	2.54
29-29.9	3.27	2.93	3.56	2.80	2.59
30-30.9	3.32	2.95	....	2.82	2.63
31-31.9	3.38	2.97	....	2.84	2.67
32-32.9	3.44	2.99	....	2.86	2.71
33-33.9	3.50	3.01	....	2.88	2.75
34-34.9	3.56	3.03	....	2.90	2.79
35-35.9	3.61	3.05	....	2.92	2.83
36-36.9	3.65	3.07	....	2.94	2.87
37-37.9	3.68	3.09	....	2.96	2.89
38-38.9	....	3.11	....	2.98	2.91
39-39.9	....	3.13	....	3.00	2.93
40 and up	....	3.15	....	3.02	2.95

*Includes Oklahoma (sweet), part of Kansas, North Dakota, W. Texas (sweet). Some Oklahoma available for 15 cents less starting 3-17-58 and other at 10 cents less on 4-1-58. †Low cold test crude. ‡Sour.

Effective dates of broad changes: California, 4-14-58; east of California, January 3-10, 1957; Pennsylvania Grade 4-16-58.

FLAT PRICES

Louisiana:	
Bienville (distillate)	$3.05
Ville Platte	3.45
Texas:	
East Texas	3.25
Conroe	3.53
Van	3.08
Pennsylvania Grade:	
★ Bradford	4.15
★ Middle District	3.97
★ Southwest Pennsylvania	3.68
★ West Virginia	3.50
★ Buckeye Grade	3.50
Illinois Basin	3.00
Canada:	
★ Leduc-Woodbend	2.67
★ Redwater (Alta.)	2.56
★ Smiley (Sask.)	2.33
★ Pembina	2.54

FOREIGN

Venezuela:	
Cumarebo, 48°-49.9°, Tucupido	3.75
San Joaquin, 41°-41.9°, Puerto La Cruz	3.34
Oficina, 35°-35.9°, Puerto La Cruz	3.05
Tia Juana medium, 26.5°-26.9°, Amuay*	2.55
Quiriquire, 16.0°-16.4°, Caripito	2.30
Lagunillas heavy, flat, Amuay or Las Piedras*	2.25
Bachaquero, flat, 15°-16°, Las Piedras*	2.05

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):	
Arabian, 36.0°-36.9°, Ras Tanura	$2.12
Iranian, 34.0°-34.9°, Bandar Masur	2.04
Iranian, 34.0°-34.9°, Abadan	1.99
Iraq, 35.0°-35.9°, Fao	1.98
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.85
Qatar, 41.0°-41.9°, Umm Said	2.23
Middle East, E. Mediterranean:	
Arabian, 36.0°-36.9°, Sidon	2.49
Iraq, 36.0°-36.9°, Tripoli, Banias	2.49
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°	2.75

TANKER RATES PER LONG TON

(Latest reported spot fixtures)

★ Gulf-U.S.N.H., clean (USMC—37.5%)	$1.78
★ Gulf-U.S.N.H., dirty (USMC—35%)	1.85
Carib.-U.S.N.H., dirty (Scale—52.5%) (8s. 0d.)	1.12
P.G.-U.K., dirty (USMC—62.5%)	4.09

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THOUSAND POUND working pressure, low temperature Natural Gasoline Extraction plant. New 1950, built by Black, Sivalls & Bryson, capacity 10 MMCF. Will sell whole or in part. Contact Drew Cornell, Inc., P. O. Box 1267, Oil Center Station, Lafayette, Louisiana.

20,000 FT. OF 1¼" EUE Seamless Well Tubing, T&C, 21 ft. R/L. Excellent condition. Price—30c foot F.O.B. our yard. M. KAPLAN & SON, INC., Monroe, Louisiana. Phone FAirfax 2-5112.

1956 FAILING 1500, G-D pump, long mast, pipe and auxiliary equipment. 1955 I-R 600 Gyroflo compressor truck mounted. Richard Travis, Box 1283, Phone CHapel 2-8331, Grand Junction, Colorado.

FOR SALE at Wichita, Kansas, 1—5' x 24'11" used Tulsa type vertical dephlegmator, code welded, 3/8" shell FQ, ½" heads FQ-ASME, 6 trays 20" spacing ½" thick, large 16 ga. bubble caps, 17% chrome stainless steel 1" slot design, risers 2" OD 13 ga. boiler tubes, serial No. 1817, WP 75#, temp. 450° F., corrosion allowance .166. New 1944. $1500.00. Cities Service Oil — Patridge — Bartlesville.

25,000 FEET 16" O.C.
USED GAS LINE PIPE
¼" wall, 42 pounds per foot
16-20' random lengths
Machine Cleaned—Beveled Ends
BROWN-STRAUSS CORP.
1546 Guinotte Ave.
HA. 1-1000 Kansas City, Mo.

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1500 HP D.C. MOTORS

1500 HP—525 volts D.C.—600 R.P.M.—NEW—2-bearing continuous duty motors—manufactured by Westinghouse. In original crates. From Navy Destroyer Escort. SPECIFICATIONS: 2-bearing 1500 HP—525 volts DC—2270 amps—600 RPM—ambient temperature 40° C—class B insulation—2-bearing pedestal sleeve type—shunt wound—efficiency 94.23%. ONLY 6 AVAILABLE—BUY NOW AND SAVE. Suitable for steel mill drive—offshore oil rigs—rolling mill drive—dredge pump applications.

1200 KW GENERATORS

(2) Equal to new—manufactured by Allis-Chalmers. 1200 KW—525 volts D.C. —2290 amps—750 RPM—cooling self-ventilated—totally enclosed—separate excitation—continuous duty—class B insulation —Mfg. type M.H.C.—frog leg armature.

The Boston Metals Co.
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MUST SELL—24L, 28L and 36L Bucyrus complete with Tools from 12" down, also 1500 Failing complete. Box 1215, Tulsa 1, Oklahoma. Phone DI 3-9563.

1 36L BUCYRUS Spudder complete with 5 and 7 inch tailing in tools. Dog house, butane tank, junk rack and light plant. Rod and tubing tools and hand tools. Phone Office 144, Res. 614, Cleveland, Oklahoma.

WELL DRILLS - CORE DRILLS. Everything for well and core drilling in both new and used equipment, at money saving prices. Fishing tools rented. Send for bulletins. Pressey & Son, Pueblo, Colo.

CABOT PUMPING UNIT, Witte engine, 2900' 5½" casing, rods, pump, 3—220 barrel tanks, complete well equipment, located Sabetha, Kansas. Telephone DIamond 3-8292, Tulsa, Okla.

WELL SERVICING Equipment—Wichtex C-60 and C-65 heavy duty double drum units mounted on tandem trucks, three Ford pickup trucks plus complete tools, lines and equipment. Priced to sell. Located Abilene, Texas. Phone OR 2-5734, Abilene, or ED 6-3788, Fort Worth.

2—Cooper-Bessemer GMR-3 and
1—Worthington LCE-6, 225 HP Angle
Type Compressors.

Each equipped with 3 compressor cylinders. Machines disassembled and ready for shipment. Location—North Central Texas.

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two to ten thousand feet. Terms available. Will lease with option to purchase. For price and location contact

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G. D. DRYDEN—AM 5-2611
604 Petroleum Building
Wichita, Kansas

FOR SALE EQUIPMENT

2 WALKER-NEER SPUDDERS—Models C-34 & S-33. Complete drilling and completion tools—Robert Boyle, Okla. City, Okla.

1 GMC PERFORATING TRUCK, complete with Gamma Ray logging equipment. 20,000' line capacity. Perfect condition. Will sell with or without logging equipment and line. Box K-487, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE: Rotary Rig Complete with National T-20 Drawworks single powered by WAK Waukesha Engine, 87' Lee C. Moore Jackknife, 7¼"x14" Oilwell Pump single powered by LeRoi L-3000 V-12 engine. 4750' of good 4½" drill pipe. 10 Drill Collars and all necessary equipment to complete rig. Call or write Travis Drillers, Inc., P. O. Box 1097, Austin, Texas. Phone GR 7-7725 or GR 8-5044.

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HORIZONTAL ALUMINUM TANK, 20,000 gallons capacity, 9'x44'. Excellent. Refinery Materials Co., JA 3-2189, Box 14306, Houston 21, Texas.

8500' RIG COMPLETE, ready to go. Located in Ward Cty., No. Dak. Will take interest with responsible parties. Box 1724—Ph. 9-3193, Billings, Montana.

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GAS FIELD SEPARATION EQUIPMENT
all skid mounted
100 Ton Mechanical Refrigeration Unit with integrated 25MMCFD Low Temperature Separation Unit located in Duval County. See, call or write R. G. Carlin.
DELHI-TAYLOR OIL CORP.
Corrigan Tower Dallas, Texas

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14' x 21' x 1" Shell, Steel
12' x 43' x 3/8" Shell, Steel
8½' x 19' x ¼" Shell, T-316SS
14" x 40' Tower, 160#
18" x 23' Tower, 160#
24" x 28' Tower, 550#

8' x 75', 20 Tray, 25#
5' x 96', 40 Tray, 135#
24" x 45', 24 Tray
18" x 32', 15 Tray, 160#
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18" x 23', 11 Tray, 220# T-316SS
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Valves: Steel & SS ½" through 6"
Furnaces: Petro-Chem, ½, ¾ mil. BTU-HR.

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Braun 3,300 sq. ft., steel, new
Steel Tube: 1000, 900, 650, 500, 300, 200, sq. ft.
Adm. Tube: 2250, 2200, 1300, 900, 740, 625, 300 sq. ft.
S.S. Tube: 1228, 947, 570, 536, 380, 315, 250, 157 sq. ft.
4-6% Chr. Tube: 1000, 500 sq. ft.
Fin Tube: 73, 21, 11 sq. ft.

PUMPS

Hot-Oil: 324 gpm @ 4600'; 735 gpm @ 3100'; 400 gpm @ 2000'; 1270 gpm @ 408'.
Water: 10,500 gpm @ 135'

COMPRESSORS

Worth.: LTC-8, Gas Engine, 880 hp.
Penna.: 100 CFM @ 500#; 385 CFM @ 160#

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2401 Third Ave., New York 51, N. Y., CYpress 2-5703

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FOR SALE EQUIPMENT

—LIQUIDATIONS—

TIDEWATER OIL CO.
DRUMRIGHT, OKLA.

FURNACES - BLOWERS - REACTORS - KILN - TOWERS - FINES SEPARATORS - ELUTRIATORS - HEAT EXCHANGERS - REBOILERS - PUMPS - COMPRESSORS - RECEIVERS - BINS & HOPPERS, ETC., FROM HOUDRIFLOW CAT CRACKER.

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TOWERS—PROPANE GAS—dual 20,000 gal./day, also 6' x 30', 5' x 58'
AGITATORS—20' x 28'4" Cone Bottom (2)
SEPARATOR—Hardinge Classifier, Oil/Water.
REBOILERS—750 to 993 Sq. Ft. 125 to 350 PSI
CONDENSERS—331 to 1500 Sq. Ft. Steel/Adm.
TUBES—NEW—Seamless 4-6% Chrome 4" to 6⅝", ⅝" to 1" Steel, Admir. & Alum.
PUMPS—Centrifugal—Steam—Hot Oil.
TANKS—300 to 18,000 gal.—500 to 80,000 Bbl. 6,500 gal. PROPANE—10,000 Bbl. HORTONSPHERE.
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ALLEN, OKLA.

REACTORS—6' x 42' 345 PSI @ 850° F.
REBOILER—318 Sq. Ft. 325 @ 350° F.
PRESSURE VESSELS—10' x 15'—4' x 5'—3' x 7'—2' x 6'—18" x 22'— 12" x 18'
CONDENSERS—80 to 480 Sq. Ft. Steel/Admir.
EXCHANGERS G FIN—100 Sq. Ft.
NEW FURNACE TUBES—Croloy 5—2⅝" to 4" OD.
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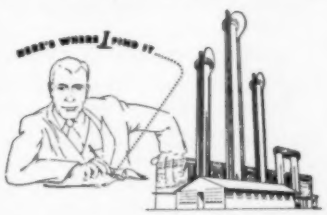

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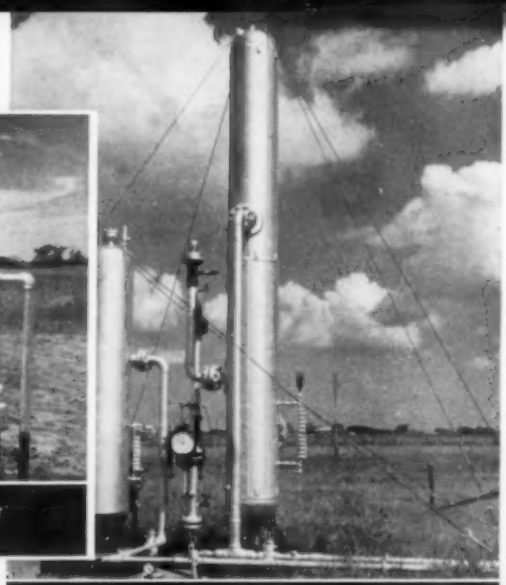

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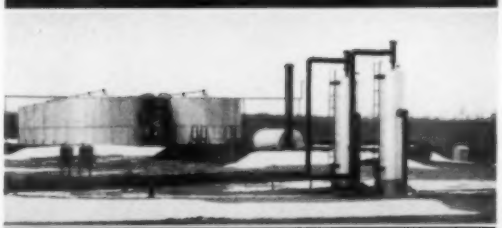

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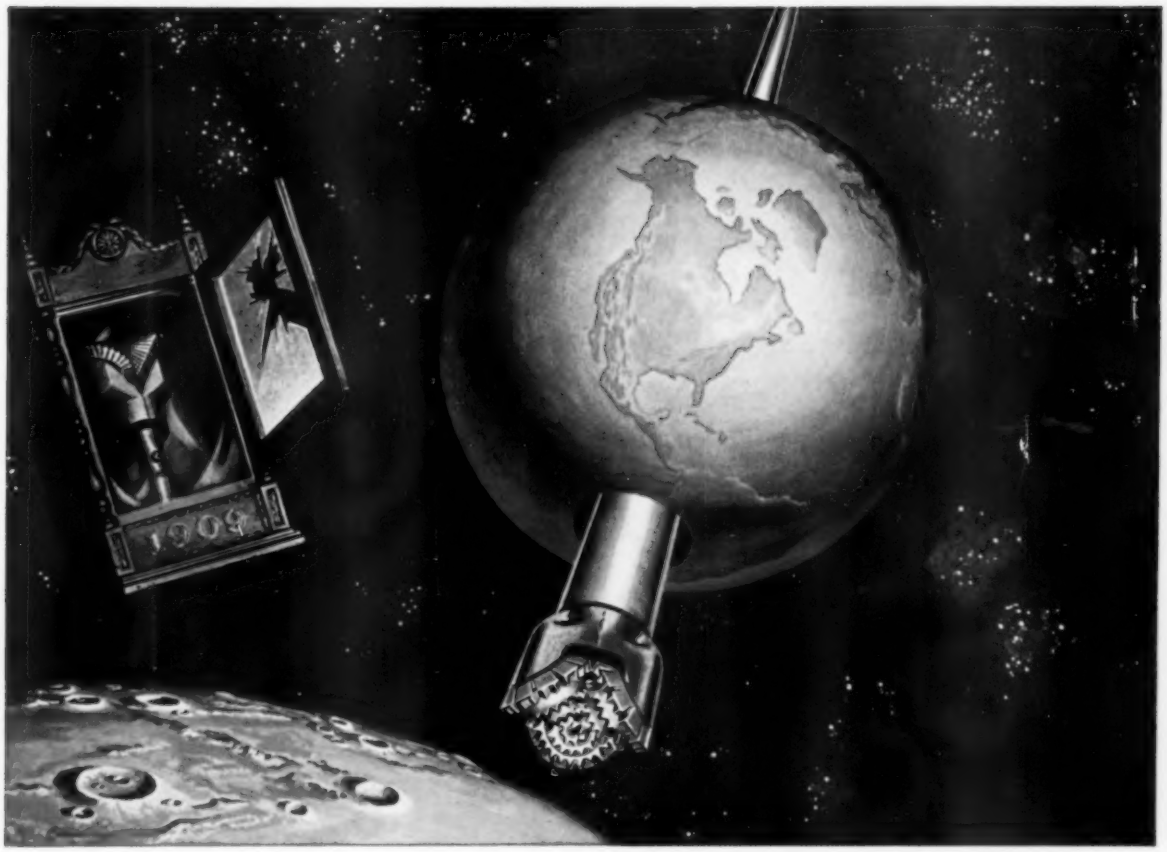

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The footage drilled by Hughes bits since 1909 exceeds 1,700,000,000 feet — or more than 40 times through the earth. This represents the industry's greatest rock bit drilling experience.

More footage has been drilled with Hughes rock bits in more formations, under more varied conditions, than with all other rock bits combined.

This rock bit performance experience, coupled with continuous research and the close co-operation of the drilling industry, enables Hughes to design and perfect bits that drill hole faster and more hole per bit!

That's why Hughes rock bits are recognized as the standard of the industry throughout the world.

Reprint of Hughes advertisement run in 1951 and 1953, with footage figures corrected to bring them up to date.